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VOLUME II

COUNTRY-BY-COUNTRY REVIEWS

AUGUST 1976

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16. ABSTRACT

A review of noise abatement programs around the world (except the U.S.) including laws, regulations, guidelines, criteria, governmental organizations, plans, research, etc., with bibliography and contact addresses to facilitate further inquiry. Volume II contains country reviews of Australia, Austria, Belgium, Sweden, Canada, Czechoslovakia, Denmark, Finland, France, Switzerland, West Germany, Netherlands, United Kingdom, Israel, Italy, Japan, Norway, Poland, Soviet Union, Latin American Countries, South Africa, and Spain. (Vol. I contains a summary and a topic-by-topic review.) Each country review is structured around an outline: (1) national laws, regulations and guidelines (occupational, emissions limits, zoning, other), (2) provincial and local legal framework, (3) enforcement and institutional data.

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1a

TABLE OF CONTENTS - VOL. II

		Page
Table of Contents		i
List of Tables (Chapter 10 only)		ii
List of Figures (Chapter 10 only)		iv
Foreward to Vol. II.		v
General Outline for All Country Sections		vi
10.	COUNTRY-BY-COUNTRY REVIEWS	10-1
10.1	Australia	10-1
10.2	Austria	10-10
10.3	Belgium	10-16
10.4	Sweden	10-19
10.5	Canada	10-26
10.6	Czechoslovakia	10-38
10.7	Denmark	10-45
10.8	Finland	10-49
10.9	France	10-53
10.10	Switzerland	10-67
10.11	Federal Republic of Germany	10-86
10.12	Netherlands	10-112
10.13	United Kingdom	10-116
10.14	Israel	10-126
10.15	Italy	10-133
10.16	Japan	10-135
10.17	Norway	10-152
10.18	Poland	10-158
10.19	Soviet Union	10-175
10.20	Latin American Countries	10-198
10.21	South Africa	10-204
10.22	Spain	10-207
REFERENCES FOR CHAPTER 10		10-210

LIST OF TABLES
(Chapter 10 only)

Table		Page
10-1	Daily Noise Dose Circulation Chart	10-3
10-2	Maximum Permitted Noise Exposure at a Work Site	10-27
10-3	Maximum Permitted Noise Exposure at Worksite	10-28
10-4	New Vehicle Limits in Czechoslovakia	10-40
10-5	Maximum Permissible Noise Limits Per Maximum Weekly Duration	10-57
10-6	Recommended Outdoor Noise Exposure Limits (Immission Standards) in DBA	10-76
10-7	Existing and Proposed Limit Values for Motor Vehicle Noise (New Vehicles)	10-78
10-8	Proposed Limits for Residential Areas near Highways	10-80
10-9	West German Noise Zone Guidelines	10-94
10-10	West German 1968 Planning Noise Zonal Limits	10-94
10-11	Estimate of Noise Abatement Costs in Road Design and Construction in the Federal Republic of Germany from 1971 to 1985	10-102
10-12	Investments for Environmental Protection in the Federal Republic of Germany, 1970 - 1979	10-108
10-13	Israeli Community Noise Law (Other than Aircraft or Traffic Noise)	10-130
10-14	Target Schedule for Abating Noise from New and existing Shinkansen Express Railroad Lines	10-136
10-15	Noise standards for New Motor Vehicles	10-137
10-16	Measures to be taken at Specific Airports in Japan	10-138
10-17	Environmental Quality Criteria for Noise	10-139
10-18	Special Environmental Quality Criteria for Noise (Roadside Areas)	10-140
10-19	Restrictive Standards for Specific Factories	10-140

LIST OF TABLES
(Continued)

Table		Page
10-20	Enforcement Standards for Construction Noise Article 14-1 & Article 15-1, Noise Regulation Law	10-141
10-21	Permissible Indoor Noise Levels in Residential Areas	10-164
10-22	Permissible Noise Levels in Worksites	10-165
10-23	Polish Corrections to Noise Limits for Various Zones	10-166
10-24	Percentage of Polish Workers Exposed to Noise and Vibration	10-167
10-25	Polish Occupational Hearing Damage by Industry	10-168
10-26a	Noise Measurement on Worksites in Textile Plants	10-169
10-26b	Noise Measurement on Worksites in Mines	10-169
10-26c	Noise Measurements on Worksites in Thermal Power Plants	10-170
10-26d	Noise Measurement on Worksites in Iron and Steel Work Works	10-170
10-26e	Noise Measurement on Worksite of Selected Engineering Plants	10-171
10-27	Work-Related Soviet Norms on Noise	10-176
10-28	I. S. O. Curve NR 75	10-177
10-29	Adjustments to Regulation 1004-73 in Respect to Noise Exposures Less Than an Eight Hour Shift	10-179
10-30	Noise Control on Trains per Sanitary Norms 877-71	10-181
10-31	Maximum Allowable Noise Levels on Board Soviet Ships	10-182
10-32	Soviet Norms on Noise in Residences	10-184
10-33	Maximum Industrial Noise Emissions to Neighboring Areas	10-185

LIST OF TABLES
(Continued)

Tables		Page
10-34	Basic Norms of SN 535-65 (Before Adjustment)	10-188
10-35	SN 535-65: Table of Adjustments for Determining the Norms for a Particular Residential Situation	10-189
10-36	City Council Act (Municipal Law) for Cordoba, Argentina: Maximum Vehicle Sound Levels	10-202
10-37	Community Noise Limits Inside Buildings for Cordoba City, Argentina	10-202

LIST OF FIGURES
(Chapter 10 Only)

Figure		Page
10-1	Dusseldorf Noise Zones	10-93
10-2	Procedures and Remedies for Noise Problems under Common Law and Statutory Law in the United Kingdom	10-125
10-3	Basic Provisions of Soviet Regulation 1004-73 Concerning Maximum Levels of Noise in Occupational Settings	10-178

INTRODUCTION TO VOLUME II

This volume contains Chapter 10, the individual reviews of noise control activities in various countries. The general outline of each country section is given on the next page.

We have used information gathered from books and from direct inquiry made to experts abroad. After a first draft was written for a country, copies of this draft were sent abroad for critical review. In this way we have tried to insure the accuracy of the information.

Naturally, we have obtained more information on some countries than others, which is reflected in the difference in length of the various sections. Occasionally, we have not obtained enough information from a country to address some point of the general outline. In that case we have usually left the caption in place, but without any textual information following it. This should be understood as indicating "no data available to us." We would be happy to receive supplementary information from readers to help fill these gaps, in the event that the report is revised again. Readers may send information to:

Noise Control Requirements and Technology Staff
Office of Noise Abatement and Control
U.S. Environmental Protection Agency
Washington, D.C. 20460

For comments on general trends among all countries, the reader is referred to the summary chapter (Chapter 1) in Volume 1.

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OUTLINE FOR COUNTRY SECTIONS IN CHAPTER 10

(Material in these sections will describe governmental noise control actions: mostly the national and local laws and regulations but also guidelines in areas where there are not yet regulations.

10.x /NAME OF COUNTRY/
(Introductory paragraph with highlights since 1971)

10.x.1 National laws, regulations, and guidelines.

- 10.x.1.1 Occupational
- 10.x.1.2 Emissions limits - existing products
- 10.x.1.3 Emissions limits - new products
- 10.x.1.4 Zoning Approaches — Zoning-type approaches controlling noise from area sources like airports construction sites, etc. (emissions) and into areas like residential areas, hospital zones, school zones, etc. (immissions).
- 10.x.1.5 Other national measures in the legal framework. (e.g.: pending legislation, special taxes, compensation to citizens affected by noise, incentives for production of low-noise products, model legislation produced by national government for adoption by state and local gov't, etc.

10.x.2 Provincial and local legal framework, if any.
Overview (short summary)
Discussion of individual jurisdiction laws and regs, if any.

10.x.3 Enforcement and Institutional Data
(Penalties, statistics, enforcing agencies, funding, etc.)

- 10.x.3.1 Enforcement
  (Includes penalties, statistics on enforcement, identification of enforcing agencies, funding, etc., also on surveys showing degree to which existing sites and equipment meet the norms, regs and laws.)
- 10.x.3.2 Institutional Data
  (Lists of organizations, addresses, capsule description of activities.) (Includes both gov't and private institutes and organizations, doing
  - a. research
  - b. development of measurement standards.)

10. COUNTRY-BY-COUNTRY REVIEWS

10.1 Australia

While the control of environmental and community noise has been primarily a state responsibility in Australia, recent years have witnessed a move in most states to centralize this responsibility under one main administrating or coordinating agency.

In an attempt to establish this approach, a committee was set up with representation from each state. This committee, which is entitled Interstate Noise Control Liaison Committee, meets four times each year. (10-1)

10.1.1 National Laws, Regulations, and Guidelines

On the national level, legislation concerning noise as a public nuisance has been limited. Noise abatement procedures to be followed by aircraft using major Australian airports have been included in the Air Navigation Act 1920, its subsequent amendments and more recent regulations. Acoustic Laboratories Act 1948 allows the Minister For Health to establish acoustic laboratories within Australia for scientific investigation into problems associated with noise. Recently The National Health and Medical Research Council of the Australian Department of Health developed model regulations for hearing conservation for the guidances of authorities concerned with health implications of occupational exposure to excessive noise. These models have been accepted in principle by all States.

10.1.1.1 Occupational

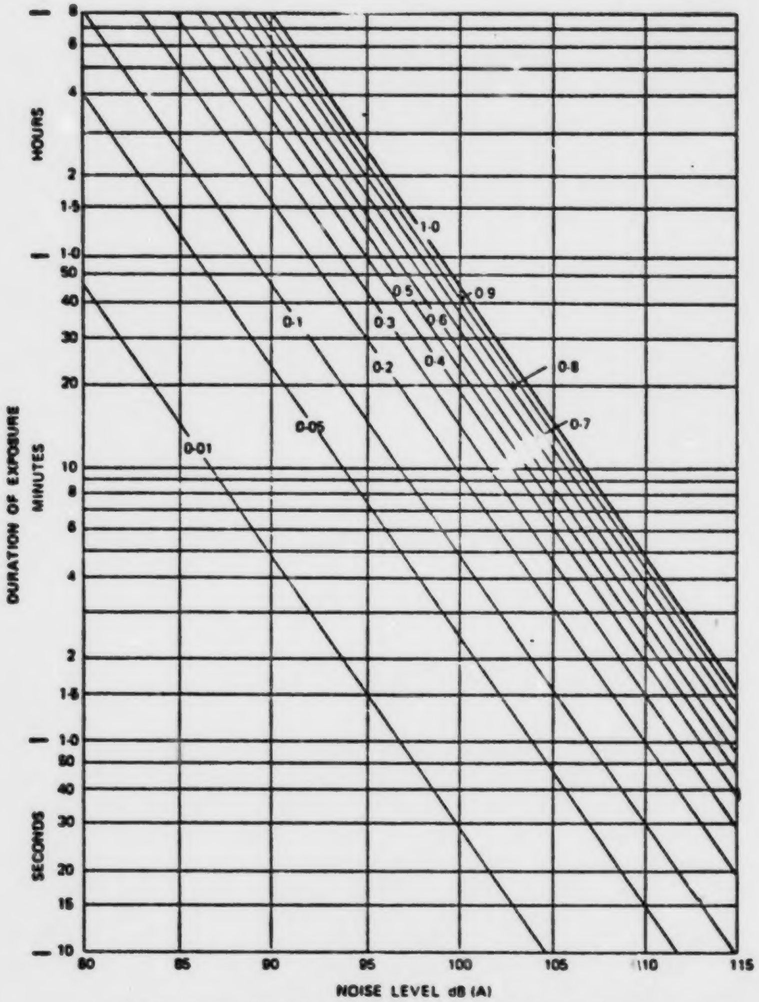
In South Australia, "Regulation 49, Noise Level" and Protection From Noise" issued under the Industrial Safety, Health and Welfare Act of 1972, has been introduced to control industrial noise exposure. Article 1 of this Regulation which was published in the "Government Gazette" on June 26, 1975, states as follows:

"The occupier of any industrial premises in which any worker is exposed to a Daily Noise Dose that exceeds 1.0 calculated in accordance with this Regulation shall, when practicable, take action to reduce noise exposure to the allowable limits by means of either --

a) engineering noise reduction
or
b) administrative noise control or a combination of both."

To determine the Daily Noise Dose, which is a summation of the various noise levels and their durations to which a worker is exposed throughout a working day, the contribution of each noise level and its associated duration is to be determined from the Daily Noise Dose Calculation Chart set out hereunder and the sum of such contributions calculated.

The method of using the Daily Noise Calculation Chart is that from the duration of exposure on any day at each noise level the decimal contribution is to be read off from the chart, for which purpose interpolation between the sloping decimal contribution lines is sufficiently accurate, and the sum of the decimal contributions from all components of noise exposure for the day is the Daily Noise Dose (Table 10-1).



"dB (A)" means the weighted value of the sound level determined with a sound level meter set to record through the A weighting network.

Table 10-1 . Daily Noise Dose Circulation Chart

Source: (10-2)

'0.1.1.2 Emission Limits-Existing Products

Aircraft

Australia is a party to Annex 16 of International Civil Aviation's Chicago Convention. Although Australia's ratification of Annex 16 has not been specifically implemented by any Act of Parliament the "Australian government has notified the ICAO that no differences will exist between its regulations and practices and the provisions of the Annex". (10-1)

Noise abatement procedures are carried out in all major Australian airports. Such procedures range from preferred runways to using prevailing wind to direct the noise away from certain areas. Regular monitoring of aircraft noise is carried out at fixed and mobile points.

While recommendations of a Select Committee On Aircraft Noise appointed by the Australian Parliament in 1970 are being implemented at the present time, other noise abatement committees at principle airports in Australia are set up to recommend any measures that might be taken to overcome local noise problems.

10.1.1.3 Emission Limits-New Products

The most important development in the legal control of motor vehicle noise control in Australia is the imposition of Australian Design Rule No. 28 to all vehicles manufactured after 1 July 1975. This rule is based on Regulation No. 9 as annexed to the United Nations Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval For Motor Vehicle Equipment and Parts. (10-1)

10.1.1.4 Zoning Approaches

Recognizing the importance of planning to avoid generating unacceptable noise levels, the Australian government moved to develop new regional growth and rezoning laws in existing cities. This new move is represented by Government involvement in the development of the Australian Capital Territory and the new Albury/Wodonga growth centers. In planning those areas emphasis has been on: (10-1)

1. Location of industry and business centers where they will not conflict with other land uses, particularly residential.
2. The planning of noise corridors for transport which are adequately separated from existing and proposed residential areas.
3. The use of the Environmental Impact Statement technique to assist in decisions when conflict involving noise and other disturbances to the environment is likely to arise, such as the siting of airports.

10.1.1.5 Other National Measures in the Legal Framework

Meanwhile the Australian Department of Urban and Regional Development is currently reviewing the need to prepare a set of noise planning guidelines which could be used by local governments.

10.1.2 Provincial and Local Legal Framework

In all Australian states legislative provisions exist that enable public or local authorities to control noise or nuisances. In general, the provisions provide for the abatement or regulation of nuisances and objectionable noise. (10-3)

Provisions dealing with motor vehicle noise emissions are found in the State Health, or Local Government Acts as well as traffic acts.

On the State level, Victoria and Western Australia have adopted a policy of zoning in legislating for noise control. Both are based on Australian Standard 1055-1973 produced by the Standards Association of Australia. New South Wales and Tasmania have provisions for licensing of scheduled premises.

Victoria was the first to pass the "Environmental Protection Act" in 1970. Western Australia, Tasmania and New South Wales have subsequently passed legislation dealing with noise.

In conclusion the nature and the extent of legal power and machinery of noise control in Australia resides chiefly in the States and can be categorized in the following manner: 1. common law right to complain which is enforceable by actions for damages or suits for an injunction to restrain the continuance or repetition of noise; 2. powers of local governing councils to prohibit or regulate noise nuisance; 3. prosecution and imposition of fines for certain noises such as those created by motor vehicles, bells, sirens, and other means in public places; and 4. diverse powers under town planning legislation to refuse approval to the new establishment of developments which may adversely affect a neighborhood in terms of noise.

Section 46 of the Victorian Environmental Protection Act 1970 states:

> "The emission of noise shall at all times be in accordance with state environmental protection policy specifying acceptable conditions for emitting noise and shall comply with any standards or limitations prescribed therefore under this Act." (10-4)

In order to broaden and to complement the noise control provisions of this Act, a bill was introduced into the Victorian Parliament in April 1975. (10-5)

The principle legislation in New South Wales is the Noise Control Act. (10-6) Part III of this Act allows the Governor to designate certain areas of the State. Any scheduled premises in these areas must apply for a license with a fixed time from the date of designation. It further makes it compulsory for the occupier of all scheduled premises to apply in writing to the Commission for approval to alter or install equipment that would increase the noise emission from those premises.

South Australia, Queensland, Western Australia, Tasmania, North Territory, and the Australian Capital Territory have legislation with provisions on nuisance and noise abatement. Such provisions have a range of penalties to ensure enforcement.

10.1.3 Enforcement and Institutional Data

10.1.3.1 Enforcement

Regulation 49 will be enforced by the Inspectors of the Department of Public Health and the Department of Labour and Industry (South Australia).

10.1.3.2 Institutional Data

The Occupation Health Branch, Department of Public Health 158 Rundle Street, Adelaide, South Australia, is engaged in applied research in the following areas (1) prediction of noise levels from road traffic, (2) attenuation of road traffic noise using earth barriers, (3) the assessment of community reaction to noise, and (4) the development of environmental noise monitoring equipment.

References for 10.1

10-1 Review of noise legislation in Australia, a paper prepared by the Australian Delegation to the Ad Hoc Group On Noise Abatement Policies, Paris, 5th Nov. 1975.

10-2 Private communication with R.G. Stafford, Scientific Officer, Department of Public Health of South Australia. Communication dated June 2, 1976.

10-3 Else-Mitchell, R. Noise Control and The Law. *Shire and Municipal Record*, Vol. 66 No. 9:737-740, Sydney 1973.

10-4 Victoria, Australia. Environmental Protection Act 1970, No. 8056.

10-5 A bill to amend the Environmental Protection Act 1970 in relation to control of noise and other matters and for other purposes. (Victoria), November 25, 1975.

10-6 A draft report "Environmental Noise Control Legislation in Australia" compiled by Environmental Protection Authority of the State of Victoria 1975.

10.2 AUSTRIA

Slow but steady progress has been made in noise control in Austria since 1972, with highlights such as a new occupational noise law in 1974 and implementation of provincial construction noise laws by an increasing number of states (Laender).

10.2.1 National Laws, Regulations, and Guidelines

10.2.1.1 Occupational

The regulation of 1974 requires that all workers continually exposed to noise corresponding to L_{eq} = 85 dB(A) during their 8-hour working day must be audiometrically examined at the time of commencing work, with review examinations every three years. (Verordnung des Bundesministers fur soziale Verwaltung, Federal Ministers Regulation No. 39, 17 January 1974. (10-7) The trading ratio in Austria is 3 dB per doubling of time. In addition, workshops where hearing damage risk exists must have signs posted indicating the noise level.

10.2.1.2 Emissions limits - existing products

The Lake Traffic Regulation of 1961 fixes at 70 phons (approx. = 70 dBA) the highest permissible level of noise disturbance (measured at a lateral distance of 25 m) caused by engines of motor boats.

Three of the nine provinces now have noise limits for existing construction equipment.

10.2.1.3 Emission Limits--new products

An aircraft certification regulation coming into force in 1975 incorporates ICAO limits on noise emissions into the certification requirements for new aircraft.

Construction Equipment

A revision of the Austrian trade law prescribes that any machine which produces a noise higher than 75 dB(A) has to be labelled with the noise emission level.

10.2.1.4 Zoning Approaches

Guidelines developed by the Austrian Working Group for Noise Abatement (OeAL) have been adopted as oficial guidelines by the Austrian national government.

In addition, there are special provisions for aircraft noise. According to the Ordinance on Civil Airports of 1962, airports may be established only in regions where landings and takeoffs are possible without flying over densely populated areas and without causing inadmissible noise disturbance.

10.2.1.5 Other Measures

Aircraft Noise

There are no curfews, either in Vienna or elsewhere in the country, but most airports outside of Vienna are small and operate in daylight hours only. Operating rules concerning minimum altitude exist and stem for the Air Traffic Regulations of 1967. (Federal Gazette No. 56, 1967).

Railroad Noise

A large switching yard now under construction was designed with noise abatement in mind. A noise study was done during the design process and noise barriers will be erected in certain areas where it was not possible to achieve low noise levels through site design.

Noise in Buildings

It is intended that all new residential buildings subsidized by the government must meet noise limits as specified in a national building code, "Sound Insulation in Buildings." This code was developed after a survey of annoyance as a function of noise and sound insulation in buildings. The draft is not yet published.

Household Appliances

A study is now underway to determine the feasibility of regulating noise from household appliances.

Criteria

The OeAL now is starting to draft a calculation method for noise annoyance around an airport. The metric will be similar to the Q index used in West Germany.

Based on a 1964 social survey in Vienna and subsequent data, it has been established that if L_{eq} is less than 55 dBA, less than 10% of the population will be annoyed by the noise environment.

Highway Noise

Feasibility of construction of noise barriers, where necessary, on newly constructed autobahns is investigated. A cost/benefits study is now being conducted.

10.2.2 Provincial and Local Framework

As previously mentioned, three out of nine provinces have enacted similar limits on construction noise. It is expected that the other six will follow in the next few years. In addition, the following have active noise offices which among other things monitor new building construction: Lower Austria, Styria, VorArlberg, and Carintia.

Vienna drew up its own new law on construction noise in force since January 26, 1973 as follows:

1) The noise level of construction equipment shall not exceed special limits for different types of machines.

2) Noise levels in designated areas are as follows:

    a. Residential

Day*	Night
50 dBA	40 dBA

    b. Mixed (residential and industrial)

Day	Night
60 dBA	40 dBA

---

* Day - period designated from 7 a.m. to 8 p.m.

c c. Industrial

Day	Night
65 dBA	55 dBA

Higher protective requirements may be enforced in areas encompassing such structures as schools, nurseries, churches, hospitals, nursing homes, etc.

These areas are also permitted to exclude certain types of heavy construction machinery and restrict night work (in technical respects). Violators of this law may be fined up to 30,000 shillings (approximately $1600) and may face up to three months in jail. (10-8)

10.2.3 Enforcement and Institutional Data

10.2.3.1 Enforcement

The Austrian Ministry of Health and Environment does not issue regulations but instead plays a coordinating role among the other Federal ministries. Enforcement of the occupational noise guidelines is accomplished through the national insurance company, Allgemeine Unfallversicherungsanstalt. Five insurance company mobile inspection stations, mounted in buses, are in use to check Austrian factories. (10-11) If companies ignore the instructions of the insurance company, they may lose their insurance and become liable for compensation costs.

Enforcement of the construction noise limits occurs at the province level. One measure of its effectiveness is that since introduced, emission levels from the construction machines have decreased on an average of about 10 dBA.

10.2.3.2 Institutional Data

Some research work is done on occupational noise hearing damage risk at the Allgemeine Unfallversicherungsanstalt
Webergasse 2
1200 Wien XX, Austria.

The Oesterreichischer Arbeitsring fuer Laermbekaempfung (OeAL, Austrian Working Group for Noise Abatement), is an activist group of lay persons including lawyers, local officials, acousticians, etc. It is the Austrian member of the A.I.C.B (see Section 2 of this report on International Organizations.

Address: c/o Dr. E. Mohr, Secretary
Stubenring 1
1010 Wien, Austria.

The OeAL issues a series of OeAL guidelines, order list for which is obtainable by request.

The leading research and engineering organization for noise control is the Physikalisch-Technische Versuchsanstalt fuer Waerme- und Schalltechnik,

Technologisches Gewerbemuseum,
1090 Wien, 9, Waehringerstrasse 59,
Austria.

Recently, Dr. Judith Lang replaced Dr. Bruckmayer as head of this institute. The institute does consulting for industry as well as work for the government and basic research.

10.3 Belgium

Environmental protection, including noise control, has received both governmental and legislative concern in Belgium. At present, a Secretariat of State for environment has been recently created to coordinate legislation and activities on environmental matters with the European Community. Moreover, the Ministry of Public Health has its own Service of Nuisance which is also concerned with noise problems. (10-13)

10.3.1 National Laws, Regulations and Guidelines

Following in the same vein as France and Germany, Belgium passed a general law on noise pollution dated July 18, 1973. This law, and some other regulations dealing with certain specific noise issues, establishes the basic legal framework of noise control in Belgium.

10.3.1.1 Occupational

People exposed to noise levels over 90 dBA during eight hours a day have to undergo a regular audiometric control. Similar to the U.S.A. q = 5 (95 dBA during 4 hours etc.). Maximum permissible level: 110 dBA. Maximum impulsive noise per day: 140 dB not more than 100 times.

10.3.1.2 Emission Limits-existing products

Decrees of August 9 and August 13, 1971 on general regulations for technical conditions of motor vehicles require the measurement of noise levels in motor vehicles. Noise limits are made in agreement with the limits prescribed by the Common Market. A proximity method for measurement is foreseen by the law with a maximum of 95 dBA at 75 cm distance from the motor.

10.3.1.3 Emission Limits - new products

The general law on noise pollution control of 1973 gives immediate power to the King to regulate or forbid production, import, export or sale of objects or machines capable of producing certain noises. The same law also enpowers the King to impose noise standards and limits for use of noise reduction devices. However, regulations to implement this law have seemingly not been issued. (10-14)

10.3.1.4 Zoning Approaches

The power to create noise zones corresponding to residential areas, industrial zones, recreational areas and those areas where quiet is particularly required, is given to the King pursuant to Article 1 of the same law of 1973. Acting on a proposal from the Ministry of Health, the King has already made his first order on 27 March 1974 dealing with the protection of the environment in the vicinity of raceways. A second order will appear soon limiting the noise produced by electronically amplified music in public places (dancings) and private homes. (10-14)

10.3.1.5 Other National Measures in the Legal Framework

10.3.2 Provincial and Local Legal Framework

10.2.2 Enforcement and Institutional Data

10.2 3.1 Enforcement

Enforcement of environmental regulations is carried out in general by various agents of the Ministry of Public Health and by local communal authority. Also, private university laboratories are hired by the Authorities for doing noise measurements. The responsibility for the measurement of noise levels in motor vehicles is granted to the Foundation for the Study and Research of Traffic Safety. (10-15)

10.4 Sweden

Noise is considered to be an important problem in Sweden of almost the same magnitude as air and water pollution. (10-16)

10.4.1 National Laws, Regulations, and Guidelines

Legislation dealing only with noise does not exist in Sweden at the present time. (10-17)

Noise regulations and standards are contained in different statutes which deal with environment and health issues. Provisions dealing with noise are found in the Environmental Protection Act of 1969 (10-18) and the Health Service Statute of 1958, and the Building Statute of 1957. While these form the general framework, detailed regulations have been issued to control the noise problems in certain areas. Also, according to traffic legislation and civil aviation legislation, it is possible to require certain noise measures.

10.4.1.1 Occupational

The noise problem within industry has had great priority since the early 1950's. Noise from factories is controlled by regulations which prescribe permissible exposure to noise at places of work. While these regulations and standards are enforced by support of the Industrial Safety Inspectorate, other voluntary standards are encouraged.

In the area of construction, noise control regulations are issued by the Industrial Safety Inspector. In addition to the authorities' standards, certain regulations are issued at workplaces which concern the individual workplace. For each workplace noise control programs are worked out corresponding to the particular circumstances. (10-16)

10.4.1.2 Emissions Limits-existing products

Aircraft and Motor Vehicle Noise

The traffic legislation demands that vehicles should be equipped and treated in such a way that unnecessary noise is avoided. While there have been certain regulations dealing with the traffic noise issue, there have also been difficulties reaching an acceptable noise level which would be acceptable in all situations. In trying to cope with these difficulties the Swedish Traffic Noise Committee was appointed and consequently in 1974 the Committee introduced proposals (10-19) dealing with traffic noise in cities and urbanized communities.

As far as aircraft noise is concerned, under the Civil Aviation Legislation it is possible to require noise muffling measures on the airplane itself. Also in this respect, the Civil Aviation Administration may, under the same legislation, give recommendations for flight procedures to prevent noise nuisances. In Sweden certain aircraft models are not allowed to land at all airports. (10-16)

During 1976 a more intensive focusing against aircraft noise is expected which means more restrictive requirements in this area.

10.4.1.3 Emissions Limits-new products

10.4.1.4 Zoning Approaches

With regard to planning legislation, the Building Act contains general regulations which consider the aspects of noise in this area. The Road Act claims, in general terms, that environmental effects of the road should be provided for when establishing planning guidelines.

Airports have been given special concern in this respect. According to Civil Aviation Legislation, a survey must be taken before an airport is built or comes into operation. The interest of civil aviation should be provided for as well as the interests of the people living in the neighborhood. If the noise situation cannot be satisfactorily handled, the airport is closed down. Under these terms a decision has been made to close Stockholm domestic airport to inland traffic. (10-16)

10.4.1.5 Other National Measures

Surveys have been made in most Swedish cities to assess the noise situation. Results have been presented in several reports by different foundations such as the National Swedish Institute of Public Health, the National Swedish Institute for Building Research and the Foundation for Industrial Safety and Health in Construction Industry. Special reports were also presented for certain noise areas such as airports and industrial and construction places. (10-16)

Through increased information an attempt has been made to make people conscious of the fact that noise disturbances can arise in connection with leisure activities. An attempt is being made to encourage changing to less noisy machines; for example motor-driven mowers replaced with electrical ones. Presently, a government committee is working on proposed actions against leisure boats. Interestingly, from July 1972 to July 1975, the Swedish Environmental Protection Board distributed subsidies for noise abatement to reduce noise surrounding industrial areas. Also, the Bromma airport which is situated rather close to central Stockholm, and is a source of noise for a lot of people, will be closed beginning the first of July, 1977 as mentioned previously.

As far as research in the different areas of noise in Sweden is concerned, the National Swedish Environment Protection Board listed on May 1976 the following projects which have been completed in recent years or which are expected to take place in 1976 and 1977. The principal bodies awarding grants for research are the National Environment Protection Board, the Swedish Council for Building Research and the National Board for Technical Development. (10-20)

1) Annoyance Reactions to Noise
2) Human Reactions to the Sound of Shots
3) Noise Problems in Thermal Power Stations - Sound Radiation from Chimneys
4) Noise and Dust Control in Connection with Jet Burning in the Quarrying Industry
5) Reduction of the Noise Generated in Sawmill Machinery
6) Survey of Noise in Connection with Pile Driving
7) Tire Noise - Measuring Methods, Parameter Studies, Screening
8) Sound Insulation of Facade Constructions in Existing Building
9) Externally insulated Sheet Metal Roofing - Acoustics
10) Total Facade Insulation of Building from Sound
11) Energy Economization - Noise Reduction in Existing Building Development
12) Sound Insulation of Windows
13) Effects of Sonic Booms on Buildings
14) Traffic Noise in the Urban Environment
15) Development of Sonic Boom Carpets for Single and Twin Engined Aircraft
16) Equivalent Level Curves for Aircraft Noise
17) Disturbance by Aircraft Noise
18) Municipal Traffic Noise Abatement Programmes. A Survey of Programmes and Planning
19) Development of Method for Calculating Traffic Noise

20) Reporting of Traffic Noise in a Landscape Using a Colour Jet Plotter
21) Landscaping of Trffic Routes for Reduction of Noise
22) Traffic Noise Screens
23) Annoyance Response to Traffic Noise
24) The Importance of Individual Factors in Annoyance Response to Noise
25) External Industrial Noise
26) The Annoyance Effect of Train Noise
27) Airborne and Structurally Borne Noise in Pleasure Craft
28) Effects of Traffic Noise on Sleep
29) Effects of Aircraft Noise on Birds

10.4.2 Provincial and Local Legal Framework

10.4.3 Enforcement and Institutional Data

10.4.3.1 Enforcement

It has been the responsibility of the Swedish Environmental Protection Board to keep watch over environmental noise at the national level. At the regional level the monitoring is done by the provincial governments and the boards of public health. Workplaces are supervised by the National Board of Occupational Safety and Health at the national level, and regionally by the Industrial Inspectorate. Sweden is divided into 19 industrial safety inspectorate districts.

Within the private sector, the most important area of noise control is within the occupational health service. According to a voluntary agreement between the labor market parties, the occupational health service is organized at the places of work. This consists of a medical part, supervised by specially-trained doctors and also a technical part, supervised by specially-trained engineers. The engineers are responsible for technical noise control. (10-16)

Other enforcing authorities also have important duties in controlling noise falling under their jurisdiction. They include the National Board of Urban Planning, the National Road Administration, the National Board of Health and Welfare and the National Civil Aviation Administration.

The National Insurance Department is responsible for the investigations of the hearing losses and for the amount of life insurance which will be paid. They are about 15 persons employed in this department. In about 10% of the cases they will turn to a consultant for more information in the actual case. Only hearing loss due to damage occurred during work give right to compensation. Deafness in one ear gives 10% full disablement pension and deafness in both ears gives 50%. This department has to consider approximately 6000 cases per ear.

The Foundation of the National Board of the Occupational Safety and Health attached to the National Board of Occupational Safety and Health have in the last couple of years supported 1 million. $ for investigations and research conserning noise control. This support has been divided between several groups in different types of industries.

The research and development are performed separately in different departments at hospitals, Institute of Technology and Universities. Some of the most important are given in the attached address list. (10-21)

10.4.3.2 Institutional Data

ADDRESSES TO CONTACT IN SWEDEN

1) The National Insurance Department
Fack
S-162 10 Vallingby
Sweden

2) The Foundation of the National Board of Occupational Safety and Health
Sveavagen 166
S - 113 46 Stockholm
Sweden

3) The National Board of Occupational Safety and Health
Fack
S - 100 26 Stockholm 34
Sweden

4) The Royal Institute of Technology
Department of Audiology
Fack
S- 100 44 Stockholm 70
Sweden

5) Sahlgrenska Hospital
Department of Audiology
S - 413 45 Gothenburg
Sweden

6) Karolinska Hospital
Division of Physiological Acoustics
S- 104 01 Stockholm
Sweden

7) Regional and University Hospital
S - 581 83 Linkoping
Sweden

10.5 Canada

Highway traffic noise, aircraft noise and industrial noise are a major concern in the legislative control over noise problems in Canada.

10.5.1 National Laws, Regultions and Guidelines

Legislative responsibility for noise abatement in Canada is distributed over four levels of government: federal, provincial, regional and municipal. (10-21).

Noise control provisions and regulations are found in different Acts and Statutes which stand as the basic framework for follow-up noise regulations. Among these comprehensive acts are the Environmental Protection Act of 1971, the Aeronautics Act of 1970, the Motor Vehicle Safety Act, and the Occupational Safety and Health Acts of Federal, Provincial and Territorial Governments. The Acoustics and Noise Control Committee of the Canadian Standards Association is working, through its various subcommittees, to provide standard measurement methods on which the emerging noise control legislation may be based.

10.5.1.1 Occupational

Jurisdictional responsibility for noise control regulations with respect to occupational safety and health is shared by the Federal, Provincial and Territorial Governments.

Regulations pursuant to the respective Acts specify the maximum permitted noise level that an employee may be exposed to either at any time or for a working day. The prime requirement is the reduction of noise levels, and protection features such as hearing protectors and hours of exposure should be considered interim measures pending engineering solutions. (10-22)

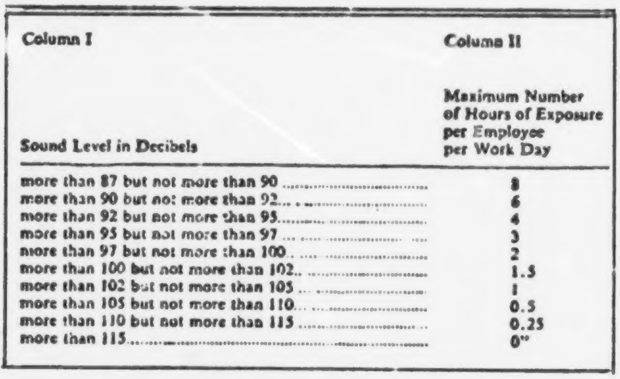
On the Federal level, Canada Noise Control Regulation which became effective on November 2, 1971 laid down maximum peak sound pressure at worksites to one hundred and forty decibles unless that employee wears hearing protectors. The same regulation also prescribed maximum permitted noise exposure at worksites as shown in the following table. (10-2)

TABLE 10-2 *Maximum Permitted Noise Exposure at a Work Site*

Column I Sound Level in Decibels	Column II Maximum Number of Hours of Exposure per Workday
90 or more but less than 92	8
92 or more but less than 95	6
95 or more but less than 97	4
97 or more but less than 100	3
100 or more but less than 102	2
102 or more but less than 105	1 · ½
105 or more but less than 107	1
107 or more but less than 110	¾
110 or more but less than 112	½
112 or more but less than 115	¼
115 or more	0

However, these limits were reduced later through an amendment of the Canada Noise Control Regulations which became effective on January 31, 1973. The following limits were adopted (Table 10-3):

TABLE 10-3 *Maximum Permitted Noise Exposure at Worksite*



Column I Sound Level in Decibels	Column II Maximum Number of Hours of Exposure per Employee per Work Day
more than 87 but not more than 90	8
more than 90 but not more than 92	6
more than 92 but not more than 95	4
more than 95 but not more than 97	3
more than 97 but not more than 100	2
more than 100 but not more than 102	1.5
more than 102 but not more than 105	1
more than 105 but not more than 110	0.5
more than 110 but not more than 115	0.25
more than 115	0"

Source: 10-23

10.5.1.2 Emissions Limits-Existing Products

Motor Vehicle Noise

No central body in Canada has responsibility for motor vehicle noise control measures. The Motor Vehicle Safety Act which came into effect in 1970 does not permit the issuance of regulations governing replacement of additional parts for noise reduction purposes (10-24). However, under this Act the vehicle manufacturer must certify that each vehicle to which he applies the National Safety Mark complies with relevant standards and regulations at its date of manufacture.

Highway traffic is regulated by provincial statutes. Each Province has a statute section or regulation requiring that all motor vehicles be equipped with an exhaust muffler in good condition, in order to prevent excessive or unusual noise.

Local municipalities have limited power to prohibit or regulate unusual noises likely to disturb inhabitants. In Canadian cities, it is general practice to minimize the traffic of heavy motor vehicles on residential streets. This is accomplished by either designating mandatory truck routes or by prohibiting through-traffic in residential areas. A number of Canadian municipalities such as Ottawa, Edmonton, and Calgary passed legislation regarding motor vehicles and noise in commercial and industrial areas.

Aircraft Noise

The Aeronautics Act and the Air Regulation Act laid down the general legal framework for aircraft noise control. The Civil Aeronautics Directorate of the Ministry of Transport is responsible for administration of the Aeronautics Act which allows the Minister general control over conditions under which aircraft may be operated. The air regulations allow the Minister to require a pilot in the vicinity of an airport to conform to policies which the Minister might make concerning noise abatement. The penalty for violation of these regulations is a fine not exceeding $1000 and/or six months imprisonment.

In August 1972 the Air Regulations Act was amended to include that "no person shall fly an aircraft in such a manner as to create a shock wave or sonic boom, the effect of which may imperil the safety of other aircraft, be injurious to persons or animals, or cause damage to property".(10-25)

Pursuant to the same amendment, the Minister of Transport on October 4, 1972 declared that "no person shall operate an aircraft in Canada in sonic, or supersonic flight unless authorized by the minister".(10-26)

10.5.1.3 Emissions Limits - New Products

Snowmobiles

A recent development in the legislative control of noise produced by snowmobiles in Canada has been the new amendment to the Motor Vehicle Safety Regulations to include new noise standards for snowmobiles. This amendment, issued on April 25, 1975 requires that snowmobiles be constructed so that the noise emitted is not in excess of 78 dBA when measured in accordance with the procedure described in SAE Recommended Practice J192a, Exterior Sound Level For Snowmobiles, November 1973.(10-27)

10.5.1.4 Zoning Approaches

No information has been available for this survey regarding this section.

10.5.2 Provincial and Local Legal Framework

Highway traffic is regulated by provincial statutes. Each Province has a statute section or regulation requiring that all motor vehicles be equipped with an exhaust muffler in good condition to prevent excessive or unusual noise.

The Ontario Environmental Protection Act of 1971 specifies that sound and vibration which result either directly or indirectly from the activities of man can be classified as contaminants. It was under this Act that Ontario initiated the first phase of its noise control program, the promulgation of vehicle noise regulations.

Noise control on the municipal level traditionally has been based on by-laws prohibiting sounds which are or may be nuisances to citizens, or on laws prohibiting noise which exceeds specific levels. The city of Toronto's noise by-laws date from 1938 in which a law was passed to eliminate horn blowing. A law passed in 1962 limits the noise of motor vehicles to 94 dBA. A law enacted in 1948 restricts industrial operations in residential areas. An amendment in 1971 to the City of Toronto Act gives the city of Toronto authority to pass by-laws for prohibiting or regulating the making, causing, or permitting of noises or any class or classes of noises within the municipality.

Legislation in other provinces and Canadian cities has been accomplished according to noise categories, including transportation noise, construction noise, noise control of stationary sources and people noise. The average municipal noise control by-laws contain a general prohibition against excessive noise for mostly nuisance control. The city of Buraby, British Columbia established noise level limits for specific time periods in relation to various types of activity causing noise nuisances (10-28). The city of Edmonton, Alberta passed legislation regarding motor vehicles and noise in commercial and industrial areas. Very similar anti-noise regulations exist for the cities of Ottawa and Calgary (10-29)

The following are laws and regulations in each Canadian province or territory relating to occupational noise (10-30):

ALBERTA

Workmen's Compensation Act (R.S.A. 1970, c. 397, am.)

General Safety Regulations (Alta. Reg. 370/72, sec. 104.18)
- Effective January 1, 1973

Lumber Regulations (Alta. Reg. 385/71, sec. 90.26)
- Effective December 31, 1971

Public Health Act (R.S.A. 1970, c. 294)

Regulations Respecting the Protection of Workers from the Effects of Noise (Alta. Reg. 30/71, am., Div. 29, secs. 1, 2 and 3)
- Effective January 28, 1971 amended by Alta. Reg. 118/73 effective May 2, 1973 and by Alta. Reg. 327/73 effective January 1, 1974.

BRITISH COLUMBIA

Workmen's Compensation Act (S.B.C. 1968, c. 59, am.)

Accident Prevention Regulations (B.C. Reg. 64/72, secs. 12.28 and 14.26)
- Effective May 1, 1972

Mines Regulation Act (S.B.C. 1967, c. 25, am., Rule 94, secs. 1, 2 and 3)
- Effective March 23, 1967

MANITOBA

Employment Safety Act (R.S.M. 1970, c. E-90)

Employment Safety Regulations (Man. Reg. 44/69, secs. 6.34 and 6.40)
- Effective March 13, 1969

NEW BURNSWICK

Industrial Safety Act (S.N.B. 1964, c. 5, am.)

Industrial Safety Regulations (N.B. Reg. 71-21, secs. 8.2.1. and 8.2.1.1.)
- Effective February 24, 1971

NEWFOUNDLAND

Workmen's Compensation Act (S.N. 1962, c. 32, am.)

Accident Prevention Regulations (Nfld. Reg. 95/69, secs. 7.11 and 8.18)
- Effective December 18, 1969

NOVA SCOTIA

Construction Safety Act (R.S.N.S. 1967, c. 52)

Construction Safety Regulations (sec. 205)
- Effective February 12, 1968

Industrial Safety Act (R.S.N.S. 1967, c. 141)

Industrial Safety Regulations (sec. 123 and 177)
- Effective February 11, 1969

ONTARIO

Industrial Safety Act (S.O. 1971, c. 43)

General Regulations (O. Reg. 259/72, sec. 111)
- Effective June 17, 1972

PRINCE EDWARD ISLAND

Workmen's Compensation Act (R.S.P.E.I., 1951, c. 178, am.)

Industrial Safety Regulations (secs. 5.8 and 5.9)
- Effective May 18, 1968

QUEBEC

Public Health Act (R.S.Q. 1964, c. 161, am.)

Industrial Hygiene Division - Noise Study - Chart

Mining Act ((S.Q. 1965, c. 34, am.)

Regulations for the Safety and Protection of Workmen in Mines and Quarries (O.C. 4389, sec. 22)
- Effective December 31, 1971

QUEBEC (cont'd.)

Industrial and Commercial Establishments Act (R.S.Q. 1964, c. 150)

Regulation Concerning Industrial and Commercial Establishments (O.C. 3787-72, secs. 5.3, 12.5, 14.2 and Appendix 3)
- Effective January 1, 1973

SASKATCHEWAN

Occupational Health Act (S.S. 1972, c. 86)

Accident Prevention Regulations (Sask. Reg. 282/69, sec. 26)
- Effective January 1, 1970

Forest "Accident Prevention" Regulations (Sask. Reg. 310/70, sec. 214)
- Effective January 1, 1971

Mines Regulation Act (R.S.S. 1965, c. 373, am.)

Regulations Governing the Operation of Mines (Sask. Reg. 87/71, sec. 53)
- Effective March 18, 1971

FEDERAL

Part IV of the Canada Labour Code (Safety of Employees) (R.S.C. 1970, c. L-1)

Canada Noise Control Regulations (SOR/71-584)
- Effective November 2, 1971
- Amended by SOR/73-66
  (New Schedule for "Maximum Permitted Noise Exposure at Worksite")
- Effective January 31, 1973

10.5.3 Enforcement and Institutional Data

10.5.3.1 Enforcement

The Canadian Ministry of Transport, Civil Aeronautics Directorate is responsible under the Aeronautics Act and the Air Regulations Act for general control and administration of conditions under which aircraft noise abatement can be made.

The Motor Vehicle Safety Act is based on the concept of self certification. Under the Act, the vehicle manufacturer certifies that every vehicle to which he applies the National Safety Mark complies with all relevant standards and regulations at its date of manufacture. Enforcement is conducted by monitoring the manufacturers documentation which supports the claimed compliance and by sample testing of production of vehicles.

In industries and establishments under the jurisdiction of a Statute controlling occupational safety and health, the power to enforce and monitor or order the monitoring of a standard of noise exposure, could, depending on the jurisdictional Agency be delegated to, a Department of Labor safety officer, a Compensation Board inspector or a Department of Health environmental health officer. These officers could be acting on behalf of either the Federal, Provincial or territorial Governments.

In as far as motor vehicle noise emission control enforcement is concerned, the Canadian Ministry of Transportation is charged with carrying out these regulations and insuring compliance with prescribed schedules and rules in accordance with the terms of the Motor Vehicles Safety Act and Motor Vehicle Safety Regulations.

Provincial responsibilities for noise control through the departments of highways, municipal affairs, and the environment, include traffic noise, zoning and other aspects of urban noise pollution relating to special sources.

Among other departments and administrations concerned with noise control issues are the Central Mortgage and Housing Corporation, the Department of Environment, and the Department of National Health and Welfare (10-31).

10.5.3.2 Institutional Data

1. Central Mortgage and Housing Corporation
Ottawa, Ontario K1A Op7

2. Noise Control Division,
Environmental Protection Service
Environment Canada
Ottawa, Ontario
K1A OH3

3. Health & Welfare Canada,
Ottawa, Ontario
K1A OK9

4. Transport Canada
Place de Ville
Ottawa, Ontario
K1A ON5

5. CSA Acoustics and Noise Control Committee,
Canadian Standards Association
178 Rexdale Blvd.
M9W 1R3

6. National Research Council
Montreal Road
Ottawa, Ontario
K1A OSI

10.6 Czechoslovakia

Although noise control in Czechoslovakia has been concerned with different sources and aspects of noise, occupational noise received more attention.

10.6.1 National Laws, Regulations, and Guidelines.

10.6.1.1 Occupational

Apart from noise limits which will be discussed later, workers are protected usually by wearing of personal protective equipment that are divided into three categories:

a. cotton wool, glass wool, plastic and resonant earplugs.
b. earmuffs.
c. anti-noise helmets.

Occupational noise is measured by the Hygienic Service in accordance with the standard CSN 01 1603 with the "Provisional uniform noise measurement and evaluation method", and evaluated according to the Hygienic Regulation No. 32. In some plants (e.g. metallurgical plants, mines) workers are regularly audiometrically examined and if partial decrease of the threshold of hearing is detected, they are displaced to another less noisy workplace.

In heavy duty plants the noise levels at some workplaces range up to 110 dBa, at large halls 86-100 dBA, and at smaller halls, offices and computing centers the noise levels range between 60 and 95 dBA.

The basic noise level limit value L_p is assessed at 80 dBA for workplaces, 40 dBA for non-productive buildings, 50 dBA for outside spaces, and 80 dBA for transport means and self-propelled working machines.

These values are further modified with the appropriate corrections in the dependence upon the kind of operation, kind of noise, local conditions, day time, etc.

Within the National Plan of Science and Engineering Development, the staff of the Acoustical Laboratory in the Occupational Safety Research Institute has investigated the sectional task "Categorization of Acoustical Conditions Control Systems", in which all kinds of workplaces were classified into specific categories according to a special code, and for each category an effective system of acoustical conditions control was worked out.

10.6.1.2 Emissions Limits-existing products

10.6.1.3 Emissions Limits-new products

The new CSN 30 0512 norm established in March 1971 replaces the CSN 30 0512 of February 19, 1964. It went into effect January 1, 1972. The norm is in agreement with the ISO 362 and with recommendations issued for the Warsaw bloc countries.

The appendix to the norm lists the maximum permissible noise emission limits for road traffic vehicles enforced in Czechoslovakia (since January 1, 1972) (Table 10-4):

Table 10-4.

Czech New-vehicle Noise Emissions Limits

Type	Limits in dBA at 7 m.	
Motor bikes & scooters		
with up to 25 km/h	70	
with up to 40 km/h	73	
Motorcycles		
displacement under 50 cu cm		
with up to 50 km/h	73	
with over 50 km/h	79	
displacment between 50 & 125 cu cm	82	
displacement between 125 & 500 cu cm	84	
displacement over 500 cu cm	86	
Three-wheel motor vehicles		
displacement under 50 cu cm	79	
displacement over 50 cu cm	85	
Passenger automobiles (all types)		84
Other motor vehicles and self-propelled machines, with a weight:		
under 3.5 t		85
between 3.5 and 12 t		89
over 12 t		
engine of not more than 147.1 kw (200 hp)		89
engine of over 147.1 kw		92

The above specifications apply to new vehicles. Existing vehicles may exceed the limits by 2 dBA. Previously the allowance for old vehicles was 5 dBA.

10.6.1.4 Zoning Approaches

10.6.1.5 Other National Measures in the Legal Framework

Czechoslovakia has the following noise measurement standards, many of which parallel the ISO standards:

CSN 01 1304 from 1966: quantities, units and symbols in acoustics.

CSN 01 1391 from 1970: devices for measuring vibrations.

CSN 01 1600 from 1966: acoustic terminology.

CSN 01 1601 from 1964: frequencies in acoustic measurements.

CSN 01 1602 from 1966: definitions of loudness and sound levels; procedures of assessment & measurement

CSN 01 1603 from 1968: methods of noise assessment.

CSN 09 0862 from 1962: noise of internal combustion engines.

CSN 12 3062 from 1973: noise and vibration of ventilators.

CSN 30 0512 from 1972: traffic noise, external noise of motor vehicles.

CSN 30 0513 from 1966: internal noise emitted by motor vehicles.

CSN 31 0305 from 1969: external noise of aircraft.

CSN 35 0019 from 1968: rotary electric machines.

CSN 36 1005 from 1967: household electric machines.

CSN 36 1006 from 1969: (in Slovak) large household electric machinery.

Besides other ones mentioned earlier, the following Czechoslovakian government standards apply to the measurement and evaluation of machinery noise:

ČSN 09 0862	Noise of compression-ignition (Diesel) engines
ČSN 12 3062	Fans. Prescriptions for measurement of noise
ČSN 17 8055	Measurement of noise emitted by computing machines
ČSN 20 0700	Safety regulations for machine tools. General regulation
ČSN 28 1304	Measurement and evaluation of noise emitted by city rail vehicles
ČSN 20 0512	Measurement of noise emitted by road motor vehicles
ČSN 20 0513	Measurement of internal noise emitted by road motor vehicles
ČSN 31 0305	Measurement of noise emitted by aircraft
ČSN 35 0019	Special testing methods for electric rotative machines
ČSN 36 1005	Noise measurement of domestic electrical motor--operated appliances
ČSN 36 1006	Noise measurement of large household electrical appliances
ČSN 21 0009	Noise measurement of forming machines.

In addition, the following standards apply to construction noise:

ČSN 73 0525	Projects concerning room acoustics
ČSN 73 0526	Room acoustics layout - Studios and enclosures for sound reception, control and monitoring
ČSN 73 0527	Room acoustics projects - Rooms for cultural and school purposes. Rooms for public purposes. Administrative rooms.
ČSN 73 0531	Protection against noise transmission in buildings.

Noise Inside Buildings

Noise is measured and evaluated also in accordance with the standard CSN 01 1603 mentioned above and with the Hygienic Regulation No. 32.

The following standards are in force:

CSN 36 8840 -	Measuring of sound insulating properties of building structures.
CSN 73 0535 -	Measurement of absorption coefficient in a reverberant chamber.

In the design stage of building interior layout the quiet workplace must be always placed a sufficient distance from noise or vibration sources, and interactively insulating half-opened enclosures, boxes or walls with noise absorption means shall be used for closed rooms according to the conditions of machine operation and inplant transport.

Suitable sound insulating constructional elements developed by the firm "Stavebni izolace" are used to reach the necessary rate of sound insulation, namely walls, boxes, enclosures, etc. with damping arrangement preventing noise propagation through joint leakages, ventilation and communication openings, air ducts, etc.

Cabins and control rooms must have sound insulating properties and the sound reduction shall correspond with the noisiness of surrounding environment. They have to be equipped also with other necessary facilities, e.g. air-conditioning plant, interior lighting, elastic bearing, signalling and safety system, etc.

10.6.2 Provincial and Local Legal Framework

10.6.3 Enforcement and Institutional Data

10.6.3.1 Enforcement

Czechoslovakia has no environmental ministry but there is an effective environmental program including noise. This is implemented through an interministerial committee, headed by a deputy prime minister, and with a secretariat in the Ministry of Health. The Ministry of Health is the CSSR lead agency in noise control.

10.6.3.2 Institutional Data

1. Ministry of Health (Ministerstvo zdravotnictvi CSSR), Praha 10-Vinohrady, W. Piecka 98
   Research Institute of Overground Building (Vyzkumny ustav ustav pozemnich staveb), Praha 10-Hostivar, Prazska 16.
2. Research Institute of Aviation Health (Vyzkumny ustav leteckeho zdravotnictvi), Praha 6-Dejvice, Kovpakova 1.
3. Institute for Research of Motor Vehicles (Ustav pro vyzkum motorovych vozidel), Praha 8-Liben, Lihovarnicka 12.
4. Research Institute of Rail Vehicles, (Vyzkumny ustav kolejovych vozidel), Praha 5-Smichov, Kartouzska 4.
5. Office for Standardization and Measurements, Praha 1, Vaclavske nam. 19.
6. Institute of Hygiene and Epidemiology, Praha 10-Vinohrady, Srobarova 48, concerns with the noise effects on human health.

10.7 Denmark

Noise from transport means constitutes the major noise source in Denmark. (10-36)

10.7.1 National Laws, Regulations, and Guidelines

At present no specific legislation on noise exists. However, certain rules are laid down in the Law of the Protection of the Environment which came into force in October 1974, public health by-laws, and police regulations. The Danish Agency for Environmental Protection has published "Guidelines" regarding permissible levels of external industrial noise, road and air traffic noise. (10-37) Also, the Building Act, the Town Planning Act, and the Traffic Act authorized the promulgation of regulations to prevent noise.

10.7.1.1 Occupational

Workers are protected from noise hazards under the provisions of the Protection of Workers Act. In this area of noise control, Danish regulations are based on ISO 1999. The legal limit is 90 dB(A) for 8 hours.

10.7.1.2 Emission Limits-existing products

Motor Vehicle Noise

The Government Inspector of Motor Vehicles has set tolerance levels for noise from motor vehicles registered after July 1969. While road traffic noise continues to be a serious problem, a proposed new law will be presented this year (1976) by the Road Noise Commission.

Aircraft Noise

ICAO Annex 16 is implemented in Denmark at the present time. Beginning February, 1975 all first-time registrations of jet aircraft should meet the noise requirements specified in Annex 16.

Construction Noise

No rules and regulations exist for this particular field. In the last two years working groups have been established within the EEC and within the Scandinavian countries. Both groups should put forward proposals for emission standards for equipment such as compressors, cranes, ventilators and earthmoving equipment.

10.7.1.3 Emission Limits - New Products

No regulations exist.

10.7.1.4 Zoning Approaches

All new airfields should be approved by environmental authorities. At present, the noise around 10 out of 12 Danish airports is analyzed. Zones with land use restrictions are now being formed. Specific limits as regards air traffic have been imposed on one airport (Roskilde). The maximum number of operations per year, operations hours, routing, noise classes of aircraft, etc. are specified in an agreement. (10-38)

According to the Environmental Protection Act of October 1, 1974 a large number of specified industries and other activities such as motordromes and shooting ranges shall not be established without prior approval by the environmental authorities. A guide regarding methods of measurement and maximum noise levels for different types of land use is given in "Ekstern Stoj fra Virksomheder". (10-38)

10.7.1.5 Other National Measures in the Legal Framework

During this year a noise-mapping program will be launched. The distribution of noise around all major noise sources such as motorways, airfields, industry, shooting ranges, etc. will be calculated or measured so as to obtain a total noise map of the country. The information will form a basis for regional and town planning.

Initiatives concerning noise from home appliances and lawn mowers have been taken by the EEC Commission, and Denmark will, as a member of EEC, take part in the EEC working group assessment of such products. (10-38) Furthermore, the first Building Act was enacted in 1960 and has been followed up by national building regulations. The regulations specify requirements for insulation between dwellings and stipulate maximum levels for noise from sanitary and heating installations.

10.7.2 Provincial and Local Legal Framework

10.7.3 Enforcement and Institutional Data

10.7.3.1 Enforcement

Pollution problems in Denmark come within the competence of several government departments where they are often dealt with in conjunction with other problems. However, the Danish Agency for Environmental Protection is responsible for the administration of the Environmental Protection Act. The agency publishes guides for noise control, and it is the appeal authority for decisions made by municipal councils, county councils and metropolitan councils. Other authorities concerned with noise problems and control include the

Ministry of Interior and the National Health Service. Special problems are dealt with by other government departments: road traffic by the Ministry of Justice; airports by the Ministry of Transportation and Communications; noise in workplaces by the Ministry of Labor.

10.7.3.2 Institutional Data

The Acoustical Laboratory
The Academy of Technical Sciences
Building 352
Lundtoftevej 100
DK-2800 LYNGBY
Denmark

10.8 Finland

The establishment of a division for the protection of the environment in the Finnish Ministry of the Interior on March 1, 1973 marks an important development in the noise abatement problems in Finland. Dealing with noise problems is one of the major functions of this division. (10-39)

10.8.1 National Laws, Regulations and Guidelines

Regulations dealing with noise abatement are included in different acts and statutes. By making use of these regulations it would be possible, when necessary, to take noise abatement measures. Such regulations are found in the following acts:

1. The Public Health Act (1965) and Implementing Regulations (1967)
2. The Planning and Building Acts (1958) and Building Regulations (1959)
3. The Road Traffic Act (1957) and Motor Vehicle Regulations (1957)
4. The Act on Certain Neighbor Relationships (1920).
5. The Act on Occupational Safety (1958) and Regulation on Medical Examinations (1971) and Noise Abatement (1974).

10.8.1.1 Occupational

Noise level limits for most occupations is 85 dBA. Measurements are carried out according to the international standard ISO 1999. Technical or constructive noise control is preferred, but hearing protectors must be available if the limit is exceeded. Audiometry is necessary every three years, when the limit 85 dB is exceeded, and every year, when the limit 100 dB is exceeded. (10-40)

10.8.1.2 Emission Limits -existing products

10.8.1.3 Emission Limits -new products

Motor Vehicle Noise

The Road Traffic Act 1957 and the Motor Vehicle Regulations issued to implement the Act contain provisions aimed at curtailing vehicle noise. The Regulations stipulated that the design of the motor car has to be such that its functioning does not cause noise which can otherwise be avoided with the aid of appropriate technical means. The Regulations also have bearing on other types of vehicles. (10-41)

10.8.1.4 Zoning Approaches

Under the terms of the Public Health Act 1965, Implementing Regulation of 1967, the Planning and Building Act 1958 and its Implementing Regulations, and the Act on Certain Neighbor Relationships, factories, plants, warehouses, and traffic roads are to be located only at such places approved by the Public Health Board.

According to the Public Health Implementing Regulations, the suitability of the location reserved for a specific purpose, e.g. when taking noise into consideration, is a prerequisite to the approval of the location.

The Planning and Building Acts make it possible for the authorities in connection with planning to ensure that industrial, warehouse and traffic areas are localized appropriately with respect to dwellings and other areas. It is stipulated that any industrial plant which, through vibration or noise, causes permanent undue inconvenience to those living on the site or in the vicinity, must not be located near a residential area or other public building site. (F.2/3)

10.8.1.5 Other National Measures in the Legal Framework

The Air Protection and Noise Control Committee proposed recommendations of a Noise Abatement Act to the Ministry of the Interior in 1973. According to these proposals measures to limit noise should primarily be carried out at the noise source. This can be achieved, for example, by paying attention to noise aspects when planning and servicing industrial equipment and machinery. As far as traffic vehicles are concerned, limits should be set for noise caused by motor vehicles. Efforts should also be made to develop traffic vehicles with less noise. Also according to these proposals, the activities causing noise should be divided into those pending permission and those which have to be reported on. The Ministry of Interior of Finland is currently in the process of drafting a noise abatement act on the basis of these recommendations.

Meanwhile a committee has also been set up by the same Ministry to report on means and ways of abating aviation noise and vibration. (10-41)

10.8.2 Provincial and Local Legal Framework

10.8.3 Enforcement and Institutional Data

10.8.3.1 Enforcement

10.8.3.2 Institutional Data (10-42)

1. Ministry of the Interior - Division of Environment Protection
Paaskylanrinne 8
SF-00500 Helsinki 50
Finland

2. Ministry of Social and Health Affairs
Snellmaninkatu 2-4
SF-00170 Helsinki 17
Finland

3. National Board of Labour Protection
Hameenkatu 13
AF-33101 Tampere 10
Finland

4. National Board of Health
Siltasaarenkatu 18A
SF 00530 Helsinki 53
Finland

5. The Acoustical Society of Finland
Arinatie 3A
SF-00370 Helsinki 37
Finland

6. National Board of Aviation
Siltasaarenkatu 12
SF 00530 Helsinki 53
Finland

7. Council of Environmental Protection
Hakaniemenkatu 2
SF 00530 Helsinki 53
Finland

8. Technical Research Center of Finland
Vuorimiehentie 5
SF 02150 Espoo 15
Finland

10.9 France

Introduction

With the establishment of the Ministere de la qualite de vie "Ministry for Quality of Life" in 1971, the struggle against noise pollution in France received a new impetus. The Ministry is responsible for coordinating interministerial and inter-organizational activities in the field of environmental protection, including noise abatement, and encouraging and supervising various programs in individual sectors of noise control, air and surface traffic, urban development, the building industry, etc.

10.9.1 National Laws, Regulations, and Guidelines

Since 1972, the following Ordinances, "Arretes" and Circulars on noise abatement have been issued in France:

"Arrete" of February 10, 1972: introduction of the "acoustic comfort label", by the Ministry of Equipment.

"Arrete" of March 13, 1972: inspection of vehicles equipped with acoustic signals, by the Ministry of Equipment

"Arrete" of March 16, 1972: noise measurements in workshops and on worksites, by the Ministry of Labor.

Circular of March 22, 1972: town planning and allotment of subsidies for residential construction, by the Ministry of Equipment.

"Arrete" of April 11, 1972: limitation of sound level of airborne noise emitted by compressor-type equipment, by the Ministries of Environment and of Equipment.

"Arrete" of April 11, 1972: limitation of sound level of airborne noise emitted by certain types of building machinery, by the Ministries of Environment and of Equipment.

"Arrete" of April 13, 1972: sound level of motor vehicles, by the Ministry of Equipment (amended by a later decree of December 31, 1974).

"Arrete" of April 13, 1972: inspection of motor vehicle exhaust systems, by the Ministry of Equipment (amended on December 31, 1974).

Circular of June 29, 1972: amendments to the "acoustic comfort label" program, by the Ministry of Equipment.

Circular of July 4, 1972: limitation of noise generated by construction machinery, by the Ministry of Equipment.

Circular of July 4, 1972: planning new and expanding existing airports, by the Ministry of Transport.

"Arrete" of November 2, 1972: amending and expanding the list of occupational illnesses, by the Ministry of Public Affairs.

Ordinance of November 3, 1972: tasks of industrial medicine, by the Ministry of Health.

Circular of November 30, 1972: workers protection from noise exposure, by the Ministry of Public Affairs.

"Arrete" of December 7, 1972: inspection and approval of acoustic (noise generating) signals and exhaust systems in motor vehicles, by the Ministry of Equipment.

Circular of January 3, 1973: setting up services on environmental hygiene, by the Ministry of Health.

"Arrete" of February 9, 1973: noise control in inland navigation, by the Ministry of Equipment.

"Arrete" of February 13, 1973: special tax on air transport companies flying over certain areas adjacent to the airports at Orly and Roissy-en-France, by the Ministries of Finances and of Transport.

"Arrete" of March 27, 1973: special tax on air transport companies, Ministry of Transport.

"Arrete" of March 27, 1973: special tax on air transport companies flying over certain areas adjacent to the airports at Orly and Roissy-en-France, by the Ministries of Finances and Transport.

Circular of June 12, 1973: details on deference to regulations on construction of apartment houses, by the Ministry of Equipment.

Circular of July 30, 1973: establishing the noise zones around airports, by the Office of the Prime Minister.

Circular of December 31, 1973: permits for town developers, by the Ministry of Equipment.

Circular of February 24, 1974: construction projects around airports, by the Ministry of Equipment.

"Arrete" of May 10, 1974: regulations on tax allotment to compensate for noise pollution of wayside and riverside areas in the vicinity of Orly and Charles-de-Gaulle Airports.

"Arrete" of July 3, 1974: noise-generating acoustic signals on ambulance-type vehicles, by the Ministry of Equipment.

"Arrete" of December 31, 1974: amendments to the Arrete of April 13, 1972, concerning motor vehicle noise, by the Ministry of Equipment.

"Arrete" of March 10, 1975: approbation of organizations responsible for measuring noise in workshops and on worksites, by the Ministry of Labor.

"Arrete" of April 14, 1975: control at a "fixed point" of the sound level of automobiles, by the Ministry of Equipment.

"Arrete" of April 16, 1975: acoustic signals of inland navigation vessels, by the Ministry of Equipment.

"Arrete" of May 5, 1975: limiting the noise level of certain types of construction machinery, by the Ministry for the Quality of Life.

"Arrete" of July 30, 1975: conditions for issuing permits on noise limitation in aircraft, by the Ministry of Transport.

"Arrete" of August 12, 1975 and October 7, 1975: methods of measuring the noise level in workshops and at worksites with the objective of protecting the worker from hearing loss

"Arrete" of November 26, 1975: limitation of noise levels generated by electric welding tools.

"Arrete" of October 17, 1975: noise limitation and labeling of household appliances and similar devices.

"Arrete" of November 4, 1975: limitation of noise levels generated by break-hammers.

"Arrete" of December 10, 1975: limiation of noise levels generated electricity supply generator.

"Arrete of April 12, 1976: last of 15 break-hammers having obtained an agreement of the government.

10.9.1.1 Occupational

The following table (10-5) gives the maximum permissible noise limits per maximum weekly duration of exposure (as of October 1975) in workshops and industrial worksites:

limits in dB(A)	group of levels in dB(A)	maximum duration of exposure per week
118	120	2.5 minutes
113	115	7.5 minutes
108	110	25 minutes
103	105	75 minutes
98	100	4 hours
93	95	13 hours
88	90	40 hours

(Levels below 88 dB(A) are disregarded).

Table (10-5) Maximum Permissible noise limits per maximum weekly duration.

Source: (10-43)

10.9.1.2 Emissions Limits - Existing Products

Aircraft Noise

To reduce engine noise of aircraft on the ground in some cases the use of silencers was made compulsory for air transport companies, especially at the Orly Airport. There are no other regulations on existing fleet at present.

As in other countries, and following the recommendations of the ICAO, the guiding principle remains the reduction of noise at the source; this in turn, in case of existing (older) aircraft, boils down to retrofitting measures, or "reconversion" as such measures are referred to in French. It is understood that retrofitting of existing aircraft must be undertaken on an international scale if such measures are to produce the desired results. Another pressing task is that of setting up the feasible periods of time within which such retrofitting could be accomplished. Because of technological problems such retrofitting would hardly be possible before 1980-81. Of course, by this date, we would already have at our disposal a considerable number of licensed aircraft of the "new generation" whose noise levels would already be below the present norms, although there is always a certain danger that air transport companies would naturally try to prolong the service life of a retrofit aircraft for as long as possible in preference to buying new and less noisy planes.

10.9.1.3 Emissions Limits - New Products

Aircraft Noise

The Decree of April 18, 1974 on noise emission limits of subsonic aircraft and their licensing (Ministry of Transport), states that no permits may be issued unless the emission limits of 108 EPNdB for aircraft not over 272 tons at takeoff (and +5 EPNdB for 4-engine craft) are observed. (10-44) Noise certification, according to a decree of July 30, 1975, is required. There is thus far no noise certification for light propeller-driven aircraft, but one is expected to be issued some time in February or March 1976.

Machinery inside Buildings

A regulation is in force for apartment buildings limiting the acoustic pressure level of noise generated by faucets etc. from a neighbor's flat at 35 dB(A), with an additional tolerance of 3 dB(A). This is specified in two existing norms (standards) NF S 31-014 for various hydraulic equipment, and NF S 31-015 for faucets. Another standard, viz. NF D 18-201 describes a properly functioning faucet. (10-45)

A special decree which would include noise characteristics of household electric appliances is evidently still pending. The decree on household appliances of October 17, 1975, issued by the Ministry for the Quality of Life (10-46) lists a number of fines which may be exacted from manufacturers, vendors or lenders of noisy household machinery.

Construction Machinery

Several decrees were issued on limiting the noise levels generated by construction machinery. Decree No. 69-380 of April 18, 1969 dealing with the soundproofing of building machines, was the first specific regulation issued on the subject. No details are available but the decree permits enacting specific orders and applying punitive measures. (10-45)

Decree from April 11, 1972 limits the noise level of various types of compressors and heat engines used in building industry. Other machinery to which noise emission restrictions are applicable are electric power tools, soldering equipment, concrete breakers and hammers. (10-45) As far as concrete breakers and hammers are concerned, the Ministry of the Quality of Life has sponsored a recent study on their soundproofing which would permit lowering the noise emission levels by an additional 6 dB(A) as compared to the previous limits. According to a decree of November 4, 1975, issued by the Ministry for the Quality of Life (10-47), starting on January 1, 1976, breakers and hammers should have the following limits: below 20 kg - 112 dB, between 20 and 35 kg - 115 dB, over 35kg - 118 dB.*

The cumulative sound pressure level (at 1 meter) of electric power tools should not exceed 85 dB(A). (10-48) Electric welding tools should not exceed the limit of 80 dB(A) measured at a distance of 7 meters. (10-49)

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* Sound power levels are given here: substract 13dB to go to sound pressure levels at 1m.distance.

The following guiding principles are observed: (10-45)

1. Noise levels depend on the type of material handled by the machines.
2. Preliminary acoustic tests are performed in laboratories approved by the Ministry of Environment: both domestic and imported materials are tested. A limit is proposed, in accordance with specifications issued by the special committee on problems of noise generated by building machines.
3. Foreign standards and regulations would be accounted for.
4. Limits are subject to modification and technological limitations are to be considered.
5. Effect of soundproofing must be evaluated.
6. Technological improvements are envisaged.
7. Regulations of the interministerial type are envisaged.

According to an agreement of May 28, 1969, supplemented and modified on May 5, 1973, all regulations are forwarded to the Committee of the European Economic Community in Brussels which may prescribe directives that would apply to all members of the Community. Limited levels will be expressed in term of sound power. (10-45)

10.9.1.4 Zoning Approaches

Airports

The Prime Minister's circular from July 30, 1973 establishes the principles of housing development in the area of airports. (10-45) The idea is to restrict the construction of dwellings in zones which are, or will be in the near future, exposed to excessive noise levels. Of particular concern are wayside and riverside communities near Charles de Gaulle and Orly Airports. According to the Decree of February 13, 1973, a tax was imposed on air transport companies which was passed over to travellers using these routes. It was easier to collect taxes this way than to tax companies in direct proportion to the decibel level produced by their planes. Taxation by decibel level per company is under study.

Noise exposure around airports is evaluated according to an isosophic index which marks off the respective zones around airports as A, B and C. (10-50) Aircraft noise monitoring exists at the following airports: Orly, Charles de Gaulle, Nice-Cote d'Azur, Bordeaux-Merignac and Toulouse-Blagnac. The system used is S.A.B.A. (surveillance automatique des bruits aeriens - automatic monitoring of aircraft noise). The criteria used is the psophic index (under revision as of December 1975).

Highways

The "Code de l'urbanisme" (Town Planning Code) is thus far the only existing French law regarding zoning and building restrictions along French highways. Residential construction, except in areas already built up, is forbidden in zones located less than 50 meters from a speedway or less than 35 meters from a high-traffic road. Within the confines of a built-up area, land use regulations are a matter of collaboration between the local communities and the pertinent administrative bodies. A number of steps have been taken to reduce the road-traffic noise.

Guidelines are available (not specified) at a ministerial level which, however, are not legally binding, that all road bed building programs in urban areas should include the necessary provision for noise reduction. Details are available in the *Guide des criteres techniques urbains* (Guidelines on technological criteria for urban constructions). (10-45)

Otherwise, the only specific data for which a legal noise limit is available are those on inland navigation routes by which noise levels should not exceed 75 dB(A) measured at a distance of 25 meters. (10-45)

Factories

The problem of noise emanating from industrial installations and the endeavour to limit such emissions may be traced as far back as the Law of December 19, 1917, France thus being one of the first European countries to tackle this predicament by issuing legislation for noise control. Presently (September 75) the Ministry of Quality of Life is working on new regulations, based on the permissible noise norm (AFNOR NF S 31.010 issued in September 1974) and its measurement in residential areas. (10-45)

10.9.1.5 Other National Measures

A circular from the Secretariat of Transportation (no date is given) grants a subsidy to communities equipping their public buses in such a way that they are actually less noisy than what is imposed as a limit by the "Code de la route" (Highway Code). (10-45) In 1975 the French Interministerial Action Committee on Nature and Environment (Comite interministeriel d'actions pour la nature et l'environnement - CIANE), decided to study the problem of taxing cars from the point of view of their noise-generating potentials. The project envisages inspecting the car according to L_{eq} measurement. A decree of April 14, 1975, provides for inspection of stationary vehicles, thus facilitating the work of technical control crews; there were 58 such crews in operation at the end of 1975. All these measures should serve as incentives for buying quieter cars. (10-45)

New aircraft landing and takeoff procedures, similar to those suggested for or introduced at other European airports (Chapter 10.10.1.2, aircraft noise in Switzerland), are being considered for adaptation. Such procedures are not too expensive, except in those infrequent cases when the trajectories are lengthened to avoid flying over residential areas. Several additional air traffic regulations aiming at noise reduction are presently under investigation, e.g. increasing the ILS slope.

Night landings and takeoffs present a separate problem. Restrictions must be carefully weighed so that, in case of transoceanic flights, connections are assured and timetables adhered to.

By a joint action of the several ministries concerned (Equipment, Interior, Transport), and in cooperation with municipalities, an action is under way to improve traffic regulations, aiming, among other things, at reducing the traffic noise by imposing speed limits, prohibiting heavy truck traffic at night, etc. However it is generally believed that mere improvements in the traffic flow do not necessarily result in a reduction of noise level. (10-45)

Noise emission regulations are the subject of the Decree No. 69-596 of June 14, 1969. It states that sound pressure levels from outdoor noise in dwellings should not exceed 35 dB(A). (10-45) It is understood that there are three different types of noise to which rooms in a building may be exposed:

1. airborne noise (transmitted from room to room)
2. direct impacts on the floor or wall
3. noise generated by various equipment

Existing regulations aim at protecting one lodger from noise generated by another who shares the same building. The reasonable level of noise is set by decree at 80 dB if the neighboring premises serve as living quarters; at 85 dB for commercial premises and shops; and at 70 dB for a mixed arrangement, in which the premises are shared. (10-45)

For impact noise, the regulations impose a sound pressure level of 70 dB(A) when the standardized impact machine (i.e. internationally standardized) is in the adjacent room.

As far as noise emitted by equipment (chosen and positioned by the builder), the regulation does not define any admissible sound pressure level for such equipment. Generally speaking, the requirements are stricter for collectively used equipment such as elevators or heaters, than for individually used equipment (faucets, drains, toilets, etc.). The respective regulations of June 14, 1969 were slightly modified by the decree of December 22, 1975: (10-51) acoustic level in rooms of an apartment remains 35 dB(A), but is set at 38 dB(A) for kitchens, bathrooms and toilets.

The basic objective is to promote living conditions superior to those set by regulations. For the noise categories covered by the regulations, the comfort lable is stricter by 3 dB(A) in general and by 8 dB(A) for lodgings.

The comfort label also includes requirements not covered by the regulations. (10-45)

1. protection of lodgings against outdoor noise (road and air traffic, etc.).
2. sound insulation of rooms for daytime living in a manner different from rooms used during the night.
3. noise protection from equipment inside buildings.

For medium-priced housing projects the "comfort lable" provides for additional grants needed for the improvement of acoustic environment, amounting up to 6.5 percent of the total loan.

The "comfort label", according to the degree of "quality living criteria" attained, consists of one star, two star or three star "awards". The extent of complementary grants depends on these degrees. Every building desiring the "comfort label" is examined twice. First examination takes place before the building is erected. At this stage, if the project is found satisfactory, a provisional label may be granted, which in turn, ensures a certain minimum of financing. A second examination, including a specific test for acoustic environment, takes place after the completion. It is now that the finished product may earn one, two or three stars. (10-45)

Another acoustic comfort label called "Acotherm" was introduced for rewarding manufacturers of windows with good acoustic properties. (10-50)

10.9.2 Provincial and Local

10.9.3 Enforcement and Institutional Data

10.9.3.2 Institutional Data

Agence de Diffusion et de Developpement des Etudes et de Recherche en Acoustique (ADDERA), Paris.

Centre scientifique et technique du batiment (Scientific and Technological Center of Building Industry), Grenoble.

Ministere de la qualite de la vie et de l'environnement (Ministry for the Quality of Life and Environment), Service des problemes de bruit (Noise Problems Service), Neuilly-sur-Seine.

Ministere de l'equipement (Ministry of Building and Equipment); Direction de la construction (Directorate for Building Industry); Direction des routes et de la circulation routiere (Directorate for Highways and Road Traffic); Paris.

Centre de formation et de documentation sur l'environnement industrial (Information and Documentation Center for Industrial Environment), Paris.

Ministere de la protection de la nature et de l'environnement (Ministry for Nature and Environmental Protection), Office of Noise Abatement, Paris.

Institute de recherche des transports (Research Institute of Means of Transport), Lyon.

Centre de recherche de medicine aeronautique (CERMA) (Research Center of Aviation Medicine), Paris.

Secretariat general a l'aviation civile - SGAC (General Secretariat of Civil Aviation), Paris.

Centre d'etudes bioclimatiques (Center for Biological and Climatological Studies), Strasbourg.

College de France (French School of Higher Education), Laboratoire de neurophysiologie generale (Laboratory of General Neurophysiology), Paris.

Electricite de France (National Company for Electricity Supply) Direction des etudes et recherches (Directorate of Research), Departement acoustique (Department of Acoustics), Clamart.

Centre d'etudes techniques des industries mecaniques CETIM (Technological Study Center for Engineering Industries), SENLIS.

Centre de recherches physiques de CNRS (Physical Studies Center of the National Center of Scientific Research), Marseille.

Groupement interlaboratoires (Inter-laboratory Group), Paris.

Conseil superieur d'hygiene publique (Higher Council of Public Health), Paris.
Consists of five sections (departments); section of Industrial Hygiene (Section de l'hygiene industrielle) is responsible for noise abatement and air pollution problems. Members of the Council are appointed for four years by the Minister of Health.

Groupement de Acousticiens de Lanque Francaise (GALF) - CNET, Dept. ETA - LANNION.

10.10 Switzerland

Despite all the measures for protecting urban areas against noise, the ambient noise in Swiss towns has increased during the last fifteen to twenty years. In order to coordinate, complete and reinforce the existing regulations a new article in the Swiss Federal Constitution concerning environmental protection was accepted in 1971 in all cantons. Under this article the Conferation was given the authority to issue regulations on noise pollution. The Federal Office of Environmental Protection (Office federal de la protection de l'environnement) was established in 1971 also to work out nationwide standards which would provide the basis for new federal legislation. An overall Environmental Protection Bill is expected to be enacted some time in 1978 or 1979, and would be applied nationwide.

At present, special working groups are meeting to set the groundwork for this anticipated federal ordinance which will establish national guidelines pertinent to noise limits. It is hoped that a unified noise measure can be worked out to apply to most noise types.

As the noise level was increasing, so was the awareness of the population. As a result, there has been an upsurge in activity at every level, from "concerned citizens" groups to government in the field of noise abatement. As mentioned earlier, the Federal Environmental Protection Agency has undertaken the role of overseeing and coordinating environmental matters on a national basis.

10.10.1 National Laws, Regulations, and Guidelines

In line with the objectives of noise abatement, Verdan defines three basic principles to be used as guidelines in planning new control measures and issuing legislation. (10-53)

These are --

1. **Wherever noise is too great at present, especially in dwellings and health establishments, all possible measures should be taken to reduce it to a tolerable level.**

2. **Noise entering existing residential areas should not exceed the tolerated noise immission standards.**

3. **Wherever possible the level of noise should be reduced by any and all means; thus in residential and health areas yet to be built the maximum levels of impinging noise normally tolerated should be lowered by some 5 to 10 dBA from present standards.**

Therefore, the future strategy should concentrate on prevention of any further noise annoyance. (10-53)

At the OECD (Organization for Economic Cooperation and Development) meeting that took place April 22-24, 1974, in Paris, the problem of noise abatement in Switzerland was summarized by Gilbert Verdan in his paper on urban environment. The paper was published as a working document on February 15, 1974 in which he surveyed the Swiss experience and existing legislation on noise abatement for the preceding decade. (10-53)

Another study on noise abatement in Switzerland (10-54) published for the meeting of the OECD-Ad Hoc Group on Policies of Noise Abatement which took place November 5-7, 1975, in Paris, discussed some of the measures taken and those in progress as of early September 1975. The paper was partially based on Verdan's study prepared a year earlier (10-53), but contains some additional material as well as actual noise limits.

In Switzerland, each canton is legally permitted to enact and enforce its own noise regulations as long as these do not conflict with national laws. Some cities have also enacted their own noise regulations, e.g., the city government of Zurich has an active noise control department.

The original noise exposure limits (Immission Standards) developed in 1959-63 by the Federal Commission of Experts on Noise Abatement (see table 10-4) are still in use. However, these noise immisssion standards are actually revised, in order to be included in the new Environmental Protection Bill.

Swiss laws and ordinances, existing and proposed, on various aspects of noise abatement are summarized as follows (10-55):

1. Existing laws and ordinances
   a. Ordinance on road transport, motor vehicle construction, and equipment (August 27, 1969).
   b. Ordinance of the Federal Department of Transport, Communication and Energy concerning noise abatement of small aircraft at the source (July 16, 1971).
   at the source (July 16, 1971).
   c. Federal law on air navigation (Dec. 21, 1948).
   d. Ordinance concerning noise zones of airports operated
   e. Ordinance concerning noise zones of airports operated on concessions (Nov. 23, 1973).

2. Official proposals of the Swiss government

   Report of the Federal Council to the Parliament on exhaust gas and noise from motor vehicles (Nov. 20, 1974).

3. Report of a Federal commission

   Protection against harmful effects along national traffic routes (final report of the Expert Commission set up by the Federal Office of Highways and Rivers, March 1974).

4. Report of the Federal Office of Environmental Protection
   a. Interpretation and application of the immission standards (1974).
   b. Measures taken and work in progress at the federal level on noise abatement (1975).
   c. Noise abatement in regard to construction sites and construction machinery (1975).

10.10.1.1 Occupational

Occupational noise is controlled by the SUVA (Federal Institute for Industrial Safety). The noise exposure limitation is evaluated in accordance with the ISO/R-1999-1971 standard.

Ambient Noise Generated by Industry and Craft Trades

The Federal Employment Act of 1964 requires advanced approval for projected industrial installations to insure compliance with noise immission standards (see Table 10-4).

10.24.1.2 Noise Abatement Measures On Existing Sources

Railroads

At present, there are no noise criteria specifically for railroad noise. It is generally acknowledged that the population is less sensitive to railroad noise than to an equal level of, for example, street noise. On an individual basis, barriers and suitable zoning regulations have occasionally been utilized to combat railroad noise. At present, the Federal Material Testing and Experimental Laboratories (EMPA) is conducting a large-scale study for the Federal Railroad System (SBB) concerning noise from railroad switching yards.

Aircraft

In Switzerland, aircraft noise near large airports is evaluated with the NNI. NNI curves have been developed for the large civil airports in the cities of Zurich, Geneva, and Basel.

Based on the NNI curves, noise zones are established in the vicinity of national airports. In each zone the land use is specifically prescribed by federal regulation. This problem is reviewed later. (10-56) Noise standards, established by the International Civil Aviation Organization concerning noise emissions by aircraft, have been applied in Switzerland since 1972.

To test the problem of annoyance caused by aircraft a socio-psychological study of aircraft noise ("Enquete socio-psychologique sur le bruit des avions") within the perimeter of three Swiss airports (Zurich, Geneva, Basel) was made. Geneva and Zurich have noise monitoring installations of the Hewlett-Packard type. (10-56)

About 4,000 people were interviewed during 1971 and 1972 on the subject of noise annoyance in the airport regions of Zurich, Basel and Geneva. In Basel, 944 persons were also interviewed on road traffic noise. The results of the survey, published in a special report (10-57) are further analyzed and exemplified in an article by E. Grandjean. (10-58)

A number of restrictions have been enacted to control aircraft noise. Swiss airports have noise monitoring systems to assure that individual aircraft do not make excessive noise. The noise limits are based upon statistical distribution of typical flyovers. Warnings are issued to violators, and if an aircraft is repeatedly noisy, the airport authorities confer with the respective airlines to correct the situation. An example of this is covered on page 227 on the Zurich airport.

For several years, a reduction in power has been required after take-off to decrease the degree of annoyance imposed on people living in the vicinity of an airport. (10-56) Also, a ban on night flying from national airports has been in force since 1972 (10-53) and no take-offs or landings are permitted at night between 10 p.m. and 6 a.m., with the exception of emergency landings.

Article 95 of the Air Navigation Ordinance specifies the night restrictions between 10 p.m. and 6 a.m., i.e., 21 and 05 hour of GMT (Greenwich Mean Time). When granting authorization for take-offs and landings of power-driven aircraft between 10 p.m. and 6 a.m., utmost restraint will be exercised, regardless of the total number of movements. Non-scheduled commercial flights are restricted for movement at Zurich between the hours of 10 p.m. and 12:30 a.m., and at Geneva, for take-offs, between 10 p.m. and 11 p.m., and for landings, between 10 p.m. and 12 midnight. Exemptions are urgent flights with the special authorization of the Federal Air Office (Office federal de l'air), forced landings, postal flights and supplemental flights during Christmas holidays. (10-59)

Supersonic flights are forbidden over the Swiss air space, persuant to Paragraph 14 of the Federal Law on Air Navigation (Loi federale sur la navigation aerienne), as of January 1, 1974. Federal regulation also forbids flying the SST in Switzerland. It is not sure that SST aircraft would ever be permitted to land (and take-off) in Switzerland even at subsonic speeds.

A special instruction was issued on March 27, 1975, concerning "low drag-low power" technique of landing in order to reduce noise nuisance in the approach zones of airports. The text reads*:

> During descent on IFR and VFR approaches an optimum clean configuration "low drag-low power" should be maintained as long as possible, i.e., landing gear, flaps, etc. should be extended as late as possible.
>
> Furthermore, cruising rpm should be maintained as long as possible in the case of aircraft equipped with variable pitch propellers.
>
> During ILS approaches the speed should be reduced on glidepath by extending gear and setting flaps gradually; however, when passing "Outer Marker" at the latest (in VMC at 500 FT AGL at the latest), landing configuration and proper approach speed should be established.
>
> During visual approaches the final approach should be carried out at an angle of not less than 3° . (10-58)

This "low drag-low power" policy was introduced for the Swiss airports in compliance with the International Civil Aviation Organization (ICAO) recommendations (AN 1/54.3 - 73/220) of January 11, 1974 . (10-53)

The Swiss government intends to re-examine the existing regulations on noise abatement for piston-engine aircraft with a take-off weight of up to 5,700 kg. (10-56) For aircraft with a heavier take-off weight, the standards established by the ICAO have been applied since 1972. (10-53)

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* IFR - instrument flight rules; VFR - visual flight rules; rpm - revolutions per minute; ILS - instrument landing system; VMC - visual meteorological conditions; AGL - above ground level.

Regulations concerning small aircraft and helicopters are still under investigation and some practical results are expected in 1976.

Actually, a special working group in the framework of ICAO is studying the problem of noise emission standardization for helicopters, following the policies of an overall reduction of aircraft noise for every type of aircraft.

With respect to the retrofit program, Switzerland is presently studying two possibilities:

a. new licensing procedures, which will start at some point in 1977 or 1978 and will require that all aircraft not complying to the limit specifications be ineligible for certification (licensing); and

b. new procedures for traffic permit renewals, beginning in 1981-1982, that would deny renewal to only aircraft already licensed for 1977-78 that exceeded the noise level limits set forth on Supplement 16. (10-56)

Specifically all such regulations and restrictions, as of January 1, 1974, are listed in full in No. 935 of the Judicial Service of the Federal Aviation Office (Office federal de l'air, service juridique) under the title: "Ordinances and Regulations in the Swiss Air Law Dealing with Noise Abatement and Environmental Protection".

Vehicles

See Table 10-7.

10. 10.1.3 Emissions Limits on New Products

10.10.1.4 Zoning and noise limit proposals

According to the revised air traffic regulations that came into force on January 1, 1974, noise zones must be established around airports that are operated under a concession. Land around airports may be used for future residential construction only if the noise level is below a given threshold or if acoustic insulation is employed (10-53) Noise-zone recommended limits have been made in the following, (Table 10-6).

Mean level L_{50}		Frequent peaks L_1		Rare peaks $L_{0.1}$		Type of zone for which these values are recommended
Night	Day	Night	Day	Night	Day	
35	45	45	50	55	55	Rest zone
45	55	55	65	65	70	Quiet residential zone
45	60	55	70	65	75	Mixed zone
50	60	60	70	65	65	Commercial zone
55	65	60	75	70	80	Industrial zone
60	70	70	80	80	90	Thoroughfares *

Table 10-6. Recommended outdoor noise exposure limits (immission standards) in dBA .

Source: (10-54)

Comments

In new areas yet to be built, it is recommended to apply noise standards reduced by up to 10 dBA from the above mentioned values.

Zurich Airport

Noise limit excesses during daytime and night-time in the Zurich airport in November 1975 are tabulated below. (10-60) these represent the results of the sound level measurements of the permanently installed noise monitoring system at Zurich Airport showing the excesses when taking-off. The limits in dBA are as follows:

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* These immission standards for thoroughfares have been replaced by the standards set for national roads

Measuring points	1	2	3	4	5	6	7	8	9
Daytime	100	95	100	90	90	105	100	100	100
Night			95	86	86				

Based on the measurement results, it is evident that single flights have exceeded the limits. Swissair has built sound-damping devices at Zurich Airport for the runup of DC-8, DC-9, and B-747 aircraft (10-56)

Road Traffic

Road traffic is generally singled out as the principal source of noise. Roulin states (10-54) that despite all efforts this problem could not be solved because of an enormous increase in the number of motor vehicles on the road during the last two decades. Federal authorities aim at attacking the problem from two aspects: reducing noise at the source and establishing a more effective control over motor traffic in general. The latter program encompasses taking measurements along the routes and a better control over noise-polluted zones (e.g. re-organizing the traffic pattern, bypassing residential areas, restricting traffic during certain hours, lowering the speed limit in certain localities, etc.)

The actually valid emission standards, registration and testing rules were issued in 1969. The restrictions on night and Sunday trucking remain in force.

The Swiss regulations are sometimes viewed as models for international standards. Since 1967, all types of vehicles in Switzerland must undergo a standard noise test. The test is carried out on level ground not covered by noise-absorbing materials as grass or snow. Measurement is made of noise from a stationary vehicle. Microphones are placed at a distance of 7 m on each side of the vehicle and at a height of 1.2 m above ground. No objects that could influence the noise measurement are allowed within a radius of 20 m from the microphones and no large objects are allowed within 50 m.

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* This is a noise limit on existing products.

The future program of noise reduction at the source envisages a new set of stricter rules for motor vehicles and an imposition of actual deadlines. On November 20, 1974, a report to this effect was put before the Parliament (Rapport du Conseil federal a l'Assemblee federale sur les gaz d'echappement et le bruit des vehicules a moteur - Report of the Federal Council to the Parliament on Exhaust Gases and Motor Vehicle Noise). The table below 10-7 summarizes the highlights of this new program:

* Existing and Proposed Limit Values for Motor Vehicle Noise (new vehicles)

Type of Vehicle	Limit in dBA Existing since 1969	Proposed for January 1, 1977
1. Motor bikes	70	68
2. Motorcycles with a cylinder capacity of up to 50 cu. cm.	73	71
3. Motorcycles of 50 to 200 cu. cm.	82	78
Motorcycles above 200 cu. cm.	82	82
4. Light automobiles with diesel engines	82	80
or engines above 50 hp	82	80
Other light automobiles	78	77
5. Heavy motor vehicles, tractors, etc. with engines above 240 hp	87	85
other types	85	83

Table 10-7. *Existing and Proposed Limit Values for Motor Vehicle Noise (new vehicles)

Source: (10-54)

* This material pertains to emissions limits on new products.

It is planned to reduce by 6 to 10 dBA the noise level of all existing motor vehicles in 1982 in relation to the levels actually valid.

As a general rule the vehicle noise is measured under performance conditions corresponding to the maximum engine power (or at full throttle).

Actually, however (until the enforcement of the levels proposed for January 1, 1977) light vehicles whose idle weight to maximum horsepower ratio does not exceed 10 kg/hp and motorcycles with a cylinder capacity above 200 cu. cm. are measured under performance conditions corresponding to 3/4 of the maximum engine power.

There are no legally binding regulations concerning noise level requirements at the driver's ear. (10-61)

Concerning all other additional control measures Roulin (10-54) p. 11) enumerates a number of steps to be taken in the near future, following the recommendations of the Federal Expert Commission set up by the Federal Office of Highways and Rivers. Their findings have been incorporated in the final report published in March 1974 under the title "Protection Against Harmful Effects Along the National Traffic Routes" (Protection contre les atteintes nuisibles en bordure des routes nationales). Guidelines in this report specify a number of administrative, legal technical measures for noise abatement along the main highways. (10-62)

In this document the following new immission standards for noise in residential areas near highways are proposed. (Table 10-8).

Timeperiod	Noise - Limit (dB(A))			
	Acceptable		Desirable	
	L_{50}	L_1	L_{50}	L_1
Day (06.00 - 22.00)	60	70	50	60
Night (22.00 - 06.00)	50	60	40	50

Table 10-8. Proposed limits for residential areas near highways.

Source: (10-62)

Depending on the situation, the noise immissions can either be measured or predicted, based on an analytical-empirical model. The criteria are in the form of recommendations rather than an ordinance, but have also been applied as criteria in legal disputes, as well as such decisions as erection of barriers, zoning, financial compensations, etc.

As a first practical result of the above mentioned report roadside barriers have been erected along many roads (predominantly along the autobahns). Alternatively, as a result of noise prognosis, the zoning plans of certain communities have been formulated so that noise-sensitive areas do not lie near the autobahns. Other possibilities sometimes employed are speed limits (for example 80-100 instead of 130 km/h) and, as a last resort, special noise-isolating building and window constructions.

Construction Sites

With a view to stimulating federal action, the Federal Department of the Interior has set up an Expert Commission at the end of 1972 to study the possibilities of controlling noise in building industries and to come up with a draft for an ordinance by the end of 1976.

All existing construction machines have been ranked by categories. One category comprises a plant required to undergo a type of approval. The equipment in a second category is also exempt from such approval and while a plant in yet a third category is also exempt, its operation must be specially authorized.

Relying on experience gained in the cantons of Aargau and Zurich, the Working Party has adopted the idea of using two relative noise limits. Each time a machine emitting noise in excess of these values is operated, a special permit is required. In a subsequent phase, it is planned to change over to a combination of relative and absolute limits. A machine emitting noise in excess of the absolute limit will be excluded from the market.

In addition to the determination of emission limits, other technical and organizational provisions have been proposed to protect people living around the construction sites.

10.10.2 Provincial and Local Legal Framework

As mentioned above, so far there are no mandatory legal provisions at the Federal level for limiting noise at construction sites. Certain cantons and/or municipalities have enacted their own ordinances for limiting noise from plants and equipment operating at construction sites. In addition to the existing ordinances issued before 1971 for the city of Bern and the canton of Zurich, the canton of Aargau enacted a similar ordinance on November 20, 1972. (10-53) The ordinances of Aargau and Zurich, instead of banning machinery that exceeds permissible noise levels, simply require that a permit must be issued each time these machines are used. As a result, contractors prefer to procure quieter machines.

The existing "Verordnung Ueber Baulaerm (Order on Construction Noise) of November 1969, passed in Canton Zurich is a strict law that has been used to shut down many construction sites until they can meet the noise norms. The basic provision of the law is a limit of 85 dBA (measured at 7 m from the source) for any piece of construction equipment, with a tighter limit of 80 dBA for certain lighter equipment of lesser capacity.

There are thus far no mandatory limits on emissions for the various types of industrial plants or machinery. The requirements are fixed in each individual case in such a way as to prevent noise around the installation from exceeding the immission standards put forward by the Federal Expert Commission. (10-53)

In Switzerland various cantons and local communities are free to enact their own noise regulations as long as they are not in conflict with federal laws. With the exception of the largest cities, the regional activity is limited to the cantonal level. As mentioned earlier, some of the cantons have well-developed noise control departments and programs. In addition, there exist noise commissions from major airports.

10.10.3 Enforcement and Institutional Data

10.10.3.1 Enforcement

Enforcement of immission standards is still inadequate, especially since the existing standards have no legal federal status. If a complaint is made that the reference noise level has been exceeded, the authorities are required to look into the situation from the technical and legal standpoints by using the immission standards merely as fundamental criteria. (10-53)

No large-scale sociological studies concerning the impact of noise within buildings have been performed so far. However, the Federal Institute of Technology at Zurich recently performed a modest survey (questionnaire to approximately 800 apartment dwellers) concerning noise within buildings.

Sound-isolation and impact-noise tests are performed both under laboratory and field conditions. The latter are often performed to resolve disputes between owner and tenants. These tests are of course less accurate than laboratory tests. Laboratory tests in Switzerland are performed predominantly in the special sound-rooms at the EMPA. These tests include, typically: doors, walls, floors, windows, and sound absorbing materials. Often, newly developed sound-proofing materials are tested under contract with private firms.

Verdan complains that insulation and soundproofing of dwellings, offices and workshops is still inadequate. Sound insulation in Switzerland is not yet prescribed by law, although in 1970 the Swiss Society of Engineers and Architects (Societe suisse des ingenieurs et architectes) issued a recommendation on this subject. The recommendation was revised in 1974, but its adoption as a standard is still pending. (10-53)

10.10.3.2 Institutional Data

On the national basis, the predominant governmental agencies concerning the noise control are the Federal Environmental Protection Agency, the Federal Air Office, the Road Traffic Division, the Federal Office for Industrie, Trade and Labor and the SUVA (Federal Institute for Industrial Safety). The Federal Institute of Technology and the EMPA (Federal Material Testing and Experimental Laboratories) have no executive power but are very active as advisers to the Government. Highly abridged, the main activities of the various Swiss organizations (10.24.16) are summarized below:

Governmental Agencies and Institutes

Eidgenoessisches Amt fuer Umweltschutz (Federal Office of Environmental Protection),3003 Bern, is an overall supervisory agency, coordinates activities of other offices and agencies.

Eidgenoessisches Luftamt (Federal Air Office), 3003 Bern, is concerned with noise problems of aircraft.

Eidgenoessische Polizeiabteilung (Federal Police Division, Road Traffic Division),3003 Bern, is concerned with emission standards for motor vehicles.

Bundesamt fuer Industrie, Gewerbe und Arbeit (Federal Office for Industry, Trade and Labor),3003 Bern, studies noise problems in various industrial sites.

SUVA (Federal Institute for Industrial Safety), 6002 Luzern, has responsibility for occupational safety, including hearing conservation.

Eidgenoessisches Amt fuer Strassen- und Flussbau (Federal Office of Highways and Rivers), 3003 Bern, studies noise on highways.

Eidgenoessische Materialpruefungs- und Versuchsanstalt (EMPA, Federal Material Testing and Experimental Laboratories), 8600 Duebendorf, does field studies and consulting in regard to noise control, room acoustics, building acoustics, and vibration.

Institut fuer Hygiene und Arbeitsphysiologie (Institute for Hygiene and Industrial Physiology), Federal Institute of Technology (ETH), Zurich, conducts research and field studies in the realm of psychoacoustics sociological surveys, etc.

Laermbekaempfungsstelle der Stadtpolizei Zurich (City Abatement Office), studies noise problems in Zurich, issues regulations.

Private Organisations

Schweizerische Liga gegen den Laerm (SLGL), 8700 Kuesnacht, (League for Noise Abatement)

Schweizerische Gesellschaft fuer Akustik, 3001 Bern
(Swiss Acoustical Society)

10.11 Federal Republic of Germany

The Federal Republic of Germany is one of the leading nations in the field of noise control.

10.11.1 National Laws, Regulations, and Guidelines

The main laws and regulations are the following (10-66):

1965 Baulaermgesetz (Construction Noise Control Act)

This Act was later replaced by parts of the Bundes-Immissionsschutzgesetz (see the 1971 report).

1968 TA Laerm (Technische Anleitung -- Schutz gegen Laerm) (Technical Noise Ordinance)

This ordinance sets noise level limits for industrial plants and installations to achieve certain ambient noise levels in neighboring areas. (10-67)
For industrial noise abatement in general, the Technical Noise Ordinance of 1968 with its ambient noise level limits was confirmed by the Pollution Control Act of 1974 though its range of application was increased.
In order to achieve an effective control of traffic noise, a two-ended approach is used in the act: noise emission limitation for vehicles and craft of all kinds, and noise abatement requirements for the planning and construction of roads and railways. These are discussed in the respective chapters on road vehicles, etc. (10-67)

1971 Fluglaermgesetz (Air Traffic Noise Control Act)

Requirements of this Act are directed to the operators of aircraft and airports to control noise. It includes general procedures for assessing aircraft noise and sets the framework for land use around approximately 40 commercial airports and military airfields throughout West Germany. In these so-called "laermschutz-bereiche" (noise protected land use zones) a compensation scheme and a number of building regulations became effective. (10-67)

1974 Bundes-Immissionsschutzgesetz (Federal Pollution Control Act)

This Act covers air and noise pollution, vibration, heat radiation and other environmental hazards. By authority of this Act, noise limits can be fixed by regulations for a variety of plants and installations (industrial and non-industrial), and for products, e.g. machinery and vehicles. Regulations are already in force for construction machinery, road vehicles, and aircraft. If public roads and railways are planned, the planning authorities have to consider ambient noise level limits in adjacent areas. In case limits are exceeded, owners of adjacent dwellings have to receive compensation for noise insulation of their buildings. (10-67)

The Bundes-Immissionsschutzgesetz is the most important environmental piece of legislation in the FRG. Its main purpose is to create uniform legal conditions throughout the country, to set standards for environmental protection, and to legislate important sectors of life which hitherto have not been regulated. Not all of the various standards and limits required by the law have been worked out thus far. The law, however, demands that those gaps be filled within the near future. (10-66)

1975 Arbeitssaettenverordnung (Working Premises Regulation)

Up till May 1976 the maximum exposure limit at working places was 90 dBA. In 1975 the above regulation was passed to become effective in May 1976. The maximum exposure limit was decreased to 85 dBA for workshops and factories. The limits of 70 and 55 dBA are to be observed for offices and for professional rooms requiring mainly mental work.

West Germany recognizes the WHO criteria and definitions regarding adverse effects of noise on human health, which are not restricted to hearing loss alone but include other health effects of noise, also of lower level noise, such as communication interference, sleep deprivation, fatigue and stress and influence on performance and work efficiency. (10-67)

Besides the regulations of the government there are a number of standards, related to all aspects of noise. They are established by Deutsches Institut fur Normung (DIN). Although the recommendations of DIN (German Standards Institution) are not legally binding, they nevertheless command much authority. DIN is therefore similar to ANSI in the U.S. There is another organization, the Verein Deutscher Ingenieure (VDI), which establishes some sort of technical guidelines, called VDI-Richtlinien. A number of Richlinien of this organization (Society of German Engineers) are also concerned with noise. They, too, are not legally binding (10. 66, p 3) by themselves but VDI 2059 Part 1 and Part 2 are introduced partially or in total by special regulations to be used in official noise rating procedures.

10.11.1.1 Occupational Noise

Since 1970 the upper level for occupational noise permitted without using earplugs, helmets, etc. has been set at 90 dBA. It is assumed that there is no hearing loss below this average value, for a working week of 40 hours, and over a period of ten years. Above 85 dBA personal noise protection measures have to be supplied by the company. Sections of high noise level within a plant shall bear signs urging the people to take personal noise protection measures. Use of such auditory protection is mandatory above 90 dBA. Before being allowed to work under noisy conditions people are required to get a hearing test. After the first year of work under noisy conditions, and every third year thereafter, they have to be retested and, if necessary, they have to be transferred to less noisy jobs and/or to get treatment by an otolaryngologist. For working in a very noisy environment (with ear plugs etc.) workers get a financial compensation for this convenience. This additional expense is a strong incentive for industry to develop and use machinery which is less noisy.

(10-66, p 10-11)

So far no legal definition of the upper limit of permitted permanent threshold shift (PTS) exists. However, it is customary for otolaryngologists, as well as for the labor unions, to use a 40 dB-down value in the audiogram at 3 KHz as the critical value for determining a serious impairment of hearing. This frequency has been chosen because it is more relevant for the intelligibility of language than the 4 KHz which usually gives the maximal overall loss. Impairment of hearing is the most common occupational diseases in the country. About 2/3 of all such losses occur in the steel industry. There is a rising tendency in the number of new legal cases involving occupational hearing losses. (10-66, p 11)

In May 1976 the Arbeitsstaettenverordnung, a new federal regulation for working conditions (Working Premises Regulation) will go into effect. The upper noise level tolerated thereafter will be 85 dBA for manual labor, 70 dBA for typical office work, and 55 dBA for creative and predominantly intellectual jobs. The noise level in general has to be as low as permitted by the type of business, and by the technology available. There have to be special rooms for recovery from normal working conditions with a noise level of less than 55 dBA. This regulation is mainly applicable to new facilities; exemptions can be made for existing factories, if warranted. (10-66, p 11)

The measurement of noise in occupational settings follows the procedures given in VDI 2058, Section 2 (German Engineering Society Guideline No. 2058, Section 2). This guideline only deals with the damaging aspects of the noise to the hearing of workers and uses the mean impulse sound level (A-weighted). In the near future the measurement method given in VDI 2058/1 will be drafted according to procedures given in the German Standard 45645. A draft version has recently been published entitled "Uniform

Measurement Method of Noise Levels for Noise Emissions". This will be the only measurement method for noise level in the FRG. One special aspect of this method is that the impulse correction is defined as the difference of the mean readings of a sound level meter set to to the dynamic characteristics I and F (or S).

Audiometric testing of noise exposed workers is done by procedures also laid out in VDI 2058/2. In the meantime, some new experiences have been published also as an amendment.

Mandatory rules for the employer concerning auditory surveillance of the employees are laid down in the Unfallverhuetungsverschrift Laerm (UVV - Laerm), Accident Prevention Regulation Noise and the Arbeitslaermschutzrichtlinie (Working place noise regulation) issued by the Federal Minister for Labor and Social Affairs.

Specifications for personal hearing protectors are given in the VDI Guideline 2560.

Inspection and control of these regulations is the responsibility of trade inspectors and of technical control officers of the accident insurance carriers.

10.11.1.2 Emissions Limits -existing products

Existing machinery and vehicles are discussed in Chapter 10.11.1.5. (p. 10-96)

10.11.1.3 Emissions Limits-new products

The VDI Report No. 239, 1975, on designing and construction of low-noise machinery, reflects the awareness of the manufacturers to comply with the efforts to reduce noise in industrial enterprises and at construction sites. Machinery is identified and described in detail. Its decibel output is given and possible damping devices are discussed. (10-68) (See also Chapter 10.11.1.5)

10.11.1.4 Zoning Approaches

Aircraft Noise

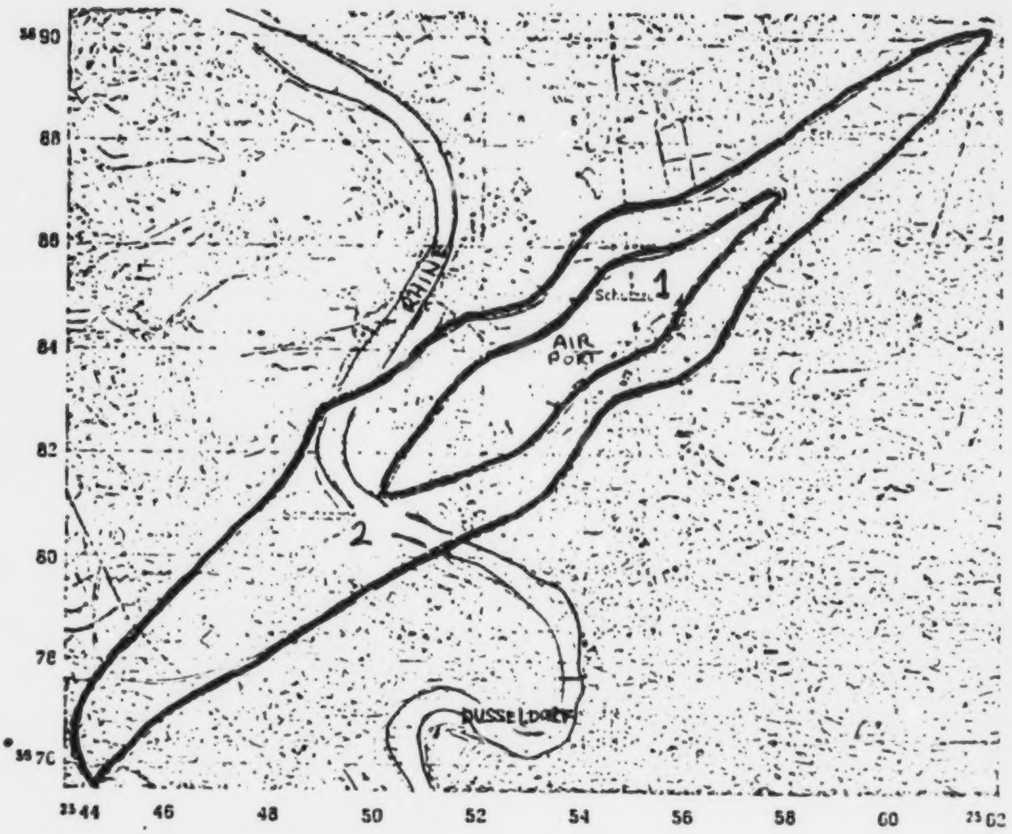
There are twelve international civil airports, about 250 general aviation airports, and 115 military airports in the FRG. In order to protect the public against the effects of jet-aircraft noise, the Gesetz zum Schutz gegen Fluglaerm (Air Traffic Noise Control Act) has been enacted in April 1971. As a result, two zones of noise around jet airports (civil as well as military ones) have been specified. In zone 1 the L_{eq} is higher than 75 dBA, while in zone 2 the noise level is between 75 dBA and 67 dBA. Noise at night is judged more serious than during the day. The zones are being calculated using complex procedures which include, among other factors, the types of aircraft using the airport and the routes. The zoning is based upon the estimated traffic result in 1981. There are several regulations as to these zones: no homes or apartment buildings can be built in zone 1. People who already live there can get up to 100 DM per m^2 (approximately 3.5 \$/sq. ft) of their home for measures to protect them against noise (improved windows, doors, etc.). In zone 2 all newly constructed buildings have to be specially modified to protect against noise. No hospitals, schools, homes for the elderly, or the like are allowed to be built there. So far about half of the jet airports have officially been assigned noise zones of this nature. All international airports in the country have to operate a permanent measuring system to monitor aircraft noise. There are no cheap night fares. On the contrary, the airports have a partial curfew, generally between 10 or 11 p.m. and 6 a.m. Enforcement of these regulations is strict. (10-66, p 5) Zoning applies also to military airfields and the regulations are consistent with those for commercial airports.

The method for calculating the noise level at a specific location is basically given in the act itself and laid down in detail in a direction issued by the responsible federal ministries. For each airport/airfield affected by the act, the air traffic noise protection area is established in a federal regulation in order to ensure uniformity of criteria and procedure. In this regulation the exact geographic limits of the noise zones are unambiguously given by coordinates and by maps using scales of 1:5000 and 1:50,000 respectively. (10-67, p. 6) In Figure 10-1, a reduced copy of the 1:50,000-map of the noise protection area of Dusseldorf is shown as an example. (10-67, p.7)

Community Noise

Details related to community noise in FRG are incorporated in a vast number of regulations of the states as well as of the individual communities. Furthermore, there are many guidelines and orders concerned with smaller sectors of community noise, but distributed over a variety of legal areas (working conditions; licensing of factories, vehicles, etc.; zoning resorts, parks, etc.). Most of this is currently being unified and much research is going on to establish feasible standards and limitations for emitted as well as for intruding noise.

Some of the noise limits usually recommended by West German authorities are shown in the following Table (10-7).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RHINE
1
Schl
AIR PORT
2
DUSSELDORF

Figure legend:

Air traffic noise protection area around the internationa airport Düsseldorf

The line around the inner zone 1 is the iso-line at 75 dBA (i.e., the line connecting points with equal L_{eq} values, at 75 dBA - only air traffic noise taken into account); the line around the outer zone 2 is the iso-line at 67 dBA.

Grid line distance: 2 kilometers

Figure 10-1
Dusseldorf Noise Zones

Type of Area	Recommended Noise Limits in dBA Daytime 6 a.m. - 10 p.m.	 Night-time 10 p.m. - 6 a.m.
Resorts, hospitals, etc.	45	35
Residential area (suburban)	50	35
Mixed residential area	60	45
(business + residential)	60	45
Industrial area	70	70

Table 10-9
West German Noise .Zone Guidlines
Source: (10-66)

For comparieon, the noise level limits established by the TA Laerm Ordinance (10-67, p. 5) of 1968 given in Table 10-10.

Zone	Ambient noise level limits in dBA Daytime 6 a.m. - 10 p.m.	 Night-time 10 p.m. - 6 a.m.
Industrial	70	70
Predominantly commercial (industrial)	65	50
Mixed (residential/commercial)	60	45
Predominantly residential	55	40
Purely residential	50	35
Hospital and sanatorial	45	35

Table 10-10
West German 1968 Planning Noise Zonal Limits
Source: (10-67)

All values are rating levels, consisting of the energy-equivalent sound pressure levels (L_{eq}) over a certain period of time and corrections for impulses and tones.

A great number of cities made thorough investigations as to levels and distribution of noise within their community. They serve as a basis for zoning purposes and city planning in general. Furthermore, in a few cities large and long-time research programs are under way to correlate the noise level actually measured with community response. Representative sections of the cities (inner city, industrial areas, suburban residential areas, etc.) are being scrutinized and analyzed separately. (10-66)

Industrial Noise Effects on Community

Since 1968 TA Laerm (Technische Anleitung zum Schutz gegen Laerm), a federal ordinance requiring the protection of the community against specified types of external industrial noise has been in effect. In order to achieve this goal, defined types of new plants and other industrial facilities have to meet certain requirements. This is also true for older outfits as well. The impact of their noise pollution on the neighboring area has to be established prior to the operating permit. Most important is that this legislation has to be used for city planning purposes. The impact of noise on people is determined by a defined measurement procedure, called Takt-Maximal-Verfahren. The method compensates for pulses and other changes of level. The principle is to use time intervals of 5 sec or less and to compute a mean noise level using only the peak values within each time interval. Corrections for pure tones are also included. The requirements for industrial noise abatement are being updated according to the changing technology. Industry can get tax credits for measures to reduce noise. (10-66, p 9).

10.11.1.5 Other National Measures in the Legal Framework

Construction Noise

In 1965 the Baulaermgesetz (Construction Noise Control Act) which was partially amended in March 1974 went into effect. It includes regulations for the emission of noise by construction machinery during operation. For each of the major types of machines (bulldozers, cranes, compressors, etc.) upper limits of noise levels are prescribed. These values have been determined by authorized experts as technically feasible. There are standardized procedures to determine the noise emission of these machines under semi-freefield conditions. Since the manufacturers want to sell their products, their various types of machines get such a standardized noise test. Those machines fulfilling the required operating conditions will be included in a list which is being published and updated periodically. Furthermore, machines which are 5 dBA or more below the limit can be labeled "fulfills superior noise protection standards". This is also being published and it is a strong incentive for the manufacturers because it gives an advantage on the market. It also enables communities, or other authorities, to demand in their construction contracts that only machines with such a superior noise insulation are allowed to be used. Every five years the technically feasible level of noise abatement shall be determined and, if necessary, new upper levels will be ordered. For buildings in the neighborhood of construction the normal values of permitted noise at the outside are valid. However, a higher noise level can be tolerated for specified shorter periods of time. Night-time is judged different from daytime. (10-66)

Construction Machinery

By the Federal Pollution Control Act of 1974, previously issued noise emission limits for construction equipment were confirmed and in its context supplemented by additional limits. An important task before fixing these limits was the development of a general procedure to measure noise emission from the different types of machinery. The resulting procedure can be recommended for yielding exact noise emission values, for its economic and general applicability, and by being approved in more than 5 years use. In a total of ten regulations, so far, limits were fixed for excavators, wheel-type and crawler-mounted loaders, concrete mixers, concrete pumps, crawler tractors, compressors, and building cranes. Based on thorough studies of the state of technology and possibilities of improved noise reduction, it was not only possible to fix limits for the present generation of equipment but also to set lower limits which will replace the present values after several years of "lead time". This approach seems to be a way which can be much more generally used to urge technical development to proceed toward less noisy designs or techniques. Positive influence in the same direction, effective in a competitive market situation, is exerted on the manufactuers of equipment by introducing in these regulations the designation of a specially earmarked class of equipment to which each model belongs as soon as its noise emission value is at least 5 dBA lower than the limiting value. This concept is similar in its effect to labelling. It requires less administrative action and, presumably, has an even better cost efficiency. (10-66)

Noise Inside Buildings

Depending on the location of the source of the noise, we have two different problems. For noise originating inside the building, there are no nationwide regulations up to this date. Nevertheless, there are a series of recommendations by both DIN and VDI dealing with noise from the heating system, home appliances, elevators, air conditioning, and the like. Most important for the insulation against noise inside the building is DIN 4109. In some of the states, one or several of these recommendations have been incorporated in laws related to noise. Hospitals, schools, etc. usually get improved sound insulation during construction. For noise coming from the outside of the building, no nationwide regulations exist so far, but there are DIN and VDI recommendations as to the sound insulation of the outer walls of buildings and of their windows. (10-66) In urban residential construction thus far, only Munich and West Berlin have a program to promote the installation of sound attenuating windows. A similar program is about to be developed in Bremen and Leverkusen on the Rhine. (10-69, p 3)

Noise from Home Appliances and Lawn Care Equipment

No national limits for the noise emitted by home appliances and lawn-mowers have been set. Since the countries of the EEC currently are working to establish uniform noise limits for these types of machinery, no purely national effort is likely in this area. The EEC countries aspire that all models of these machines are tested in a standardized way, and that information about the noise level emitted has to be included in the owner's manual, similar to the information about the power consumption. Guidelines as to upper noise levels are also being discussed.

On a private basis there is a federally subsidized consumer organization (Stiftung Warentest) conducting tests of the noise emitted by home appliances. For lawn mowers and similar equipment, federal regulations are currently being worked out. So far there is only a variety of state and local regulations usually calling for curfews at night, around noon, and on Sundays. (10-66, p 9-10)

Railroads

Noise from railroads is being attacked in various ways. First, work is going on to design cars and engines which do not produce much noise. Besides this, there is a trend to prefer concrete bridges to steel bridges, and there is a nationwide program to polish the rails of the main connections to the tune of 5000 km year (approx. 3100 miles/year), in order to get rid of the micro-ripples. The latter procedure reduces noise emission by an average of 5 dBA. The rail segments of the main connections have already been welded together in order to reduce noise and vibration. (10-66, p 7)

Motorboats

In many recreational areas throughout the country noise-related motorboat curfews have been enacted. Restrictions between types of boats, time and areas of usage, and the emitted noise level. On the lakes of Berlin there is a night-time ban of motorboat activities throughout the year, plus a partial curfew in summertime during every other weekend. (10-66, p 7)

Road Traffic

As in many other European countries, traffic noise is the most common and the most widely distributed source of noise in the FRG. In order to get a hold of the problem, 18 cities have so far worked out the distribution of noise within their municipality, in the form of more or less complete noise mappings. This has been done on a purely voluntary basis. The maps usually indicate the various levels of noise, using a bandwidth of 4 to 5 dBA. However, procedures for the technicalities have not yet been standardized. The purpose of these noise maps is to supply data for city planning. (10-66, p 6)

With respect to noise emission from vehicles, the Federal Republic issued limits in a national regulation as early as 1953 which have been successively tightened several times since. In 1970 the European Communities issued a directive containing noise emission limits for four-wheeled vehicles, whereas mopeds and motorcycles are still covered in a national regulation. In both cases, however, it is the intention of all EEC member states to harmonize future regulations within the European Communities, at the same time reducing the limits as far as possible. The Federal Pollution Control Act authorizes the federal government to transfer international obligations of this kind into the national body of laws and regulations. (10-66, p 9)

Since 1966 all new types of motor vehicles have to be tested by licensed institutions as to their noise emission and they have to meet certain noise specifications. There are many technical details for these measurements, and different upper limits, depending upon the type of the vehicle. The maximal values are between 70 dBA and 92 dBA. Technical details are similar to the ones of ISO R 362.

In a few localities, screening walls, tunnels, or the like have been constructed to protect the area around it against traffic noise. Communities are entitled to, and do, prohibit truck and motorcycle traffic in certain areas during specified night-time hours. (10-66, p 6 & 7)

West German spas and resorts lately have been busy with developing their own noise abatement programs aiming above all at limiting the motor vehicle traffic noise . (10-69, p 3)

Noise abatement requirements in planning and construction of traffic roadways include three stages: 1) careful planning and routing with respect to noise sensitive areas; 2) 2) noise-minimizing design and construction of the road or railway according to the latest state of technology, but with a cost efficiency clause and; 3) compensation for noise insulation of hospitals, schools, office buildings, dwellings, and other noise sensitive buildings if the first two stages do not lead to sufficiently low ambient noise levels. These regulations by the Pollution Control Act are supported and specified by an amendment of 1974 to the Federal Highway Act which requires the road design department to vouch for the necessary noise abatement configurations of road layout and screening in the application procedure. (10-67, p 9)

The Federal Government of West Germany intends to make regulations for traffic noise in some way similar to those in relation to aircraft noise. The noise level along streets and highways yet to be constructed will be calculated based upon the estimated traffic result. If the value calculated in that way turns out to be higher than this upper limit, measures have to be taken to protect the tenants against intruding traffic noise. A limited compensation for such expenses shall be awarded. This is for buildings already in existence. New buildings have to be adequately protected against noise from the beginning. In addition to this, an upper limit for permitted traffic noise will be set . (10-66, p. 6-7)

In road traffic noise abatement, a number of studies have been made investigating the cost dependence on the values of noise limits, both for noise emission from vehicles and for ambient noise levels near roads. These two aspects are covered together in a 1974 study initiated by the European Communities and performed by the different German universities and institutions. Very extensive investigations have also been made by the Federal Government. Table 10-11 shows approximate results as of 1974, estimating the total costs of noise reduction, e.g., by screens, walls, sound insulation, windows, in connection with construction of new roads all over the Federal Republic in the 15-year-period from 1971 to 1985.

Table 10-11

Estimate of noise abatement costs in road design and construction in the Federal Republic of Germany from 1971 to 1985.

Ambient noise level limit (in dBA)	Total cost estimate (in million DM)
75	600
70	2,600
65	7,000
60	20,000
55	51,000

Source: (10-67/11-12)

Questionnaires on noise exposure, distributed among the population in GFR, were processed as results were published in several independent studies; e.g. in Pressemitteilungen des Wickert-Institutes (25 July 1972), under the title "60 Prozent wohnen zu laut" (60 percent of population are exposed to excessive noise); or in the study by J. Mantel: Reaktion der Oeffentlichkeit im In- and Ansland auf den Laerm (Public Reaction to Noise in FRG and abroad), in Kampf dem Laerm, No. 22, 1975. Similar studies have also been made in Switzerland (see chapter on Switzerland).

Aircraft Noise

Test-runs of jet-engines can only be made in specailly protected areas or buildings at the airports. No test-runs are allowed during night-time curfew hours. Specail low-noise take-off and landing procedures are being tested at the Frankfurt airport (low drag-low power procedure according to Lufthansa). Furthermore, the Frankfurt Airport Authority arranged for a contest in environmental protection. As a result, 2.5 million Marks (approx. over a million $) have been paid to airlines for following this low-noise landing procedure and for flying low-noise aircraft over a of one year. Low-noise planes have been developed (VFW 614 and Airbus A 300B). There are no noise-related limits to helicopter flights over cities. No commercial supersonic flights are allowed in or across this country. There are plans for a partial curfew for light general aviation aircraft. Take-off and landing shall be unrestricted only in the morning and in the afternnon. Around noon and at night it shall be predominantly prohibited. (10-66, p 6) Retrofit programs for existing aircraft with the objective of adhering to the ICAO limits are presently under discussion though no concrete proposals are available. (10-69, p 6)

Compensations

Compensation for sound insulation of houses according to the Air Traffic Noise Control Act is paid in proportion to the size of the rooms to be protected (upper limit: DM 100.00 per square meter). It is difficult to estimate total costs incurred by the implementation of the Act before noise protection areas for most of the airports/airfields have been determined and issued, as the number of houses lying in the 75-dBA-zone is very different from case to case. (10-67, p 11)

Incentives

Incentives for reducing noise around airports have thus far been inadequate. The only exception seems to be the Frankfurt/Main airport. Since 1974 the airport has had a special award system for low-noise aircraft. Details are available in the VDI-Nachrichten, No. 36, 1975, under the title "Praemiensystem fuer umweltfrenndliche Flugzenge" (Awards for Low-Noise Aircraft).

10.11.2 Provincial and Local Legal Framework

A complete list of noise control regulations issued by various West German industrial enterprises is available. (10-70, p 4) Also, some German "laender" have issued their own noise abatement legislation. Land Nordrhein-Westfallen enacted legislation on March 18, 1975 (10-71), pursuant to which all noise-generating activities are prohibited between 10 p.m. and 6 a.m.

10.11.3 Enforcement and Institutional Data

10.11.3.1 Enforcement

Overview

Enforcement of some of the regulations is troublesome because no methods for adequately and cheaply measuring the noise on the spot are available so far. Work is going on to develop such procedures. The federal regulations can be sharpened by state and local orders according to special needs.

There have been two important developments within the last two years. One was the Bundes-Immissionsschutzgesetz. Many of its requirements have not yet been fulfilled, but the efforts are continuing as demanded by the law. The other is the creation of the Umweltbundesamt, enabling the Federal Government to attack environmental problems in a more systematical and efficient way. The outlook for 1976 calls for more progress along these lines. In order to achieve uniform punishment of offenders throughout the country, common types of violations are currently being defined and a catalog of corresponding fines is being specified similar to the one for traffic violations. (10-66, p 13)

Noise abatement policy implementation in Germany has reached different levels in different fields. Most successful results have been obtained so far in industrial and construction noise abatement. Especially, the Technical Noise Ordinance ("TA Laerm") has provided the trade-board official with a very effective tool to protect the resident population against noise emitted from factories and trade. (10-67, p 10)

Government Organization and Funding

In 1974 the Federal Government created the Umweltbundesamt (Federal Environmental Agency) located in Berlin. It is an independent agency subordinated to the Bundesministerium des Innern (Dept. of the Interior). The main tasks of the Umweltbundesamt (UBA) are to provide the Federal Government with scientific advice, to organize research related to environmental problems, and to operate a central environmental documentation system. The UBA thus has no executive function.

Its final organization is not yet completed, although it is approaching the stage of no more reshuffle. Currently about four hundred people are working for the agency, most of which have a scientific education. Environmental problems of various kinds are intricately interrelated, and thus members of all major branches of science are contributing their knowledge and skills.

Responsibility for all aspects of noise and vibration resides in the Laermbereich (Division of Noise Abatement and Control). It is one of the divisions within the Fachbereich Immissionsschutz (Department of Immission Control) and the plan calls for about thirty colleagues, again, about half of them with scientific background. The unique nature of noise as a technical as well as a psychophysiological phenomenon necessitates an otherwise unusual cooperation between the various branches of engineering and a wide spectrum of biological sciences. As a predominantly scientifically oriented agency, the Umweltbundesamt is not responsible for the strategies to flight pollution. These are political decisions which are being made by the Federal Government. Of course, the information required and the various options are being worked out by the UBA.

As far as noise is concerned the Bundeslaender (States) are primarily responsible, but only if the Federal Government does not act by itself. Normally a federal law, concerned with noise pollution and its effects, creates only a framework. Details (e.g. upper limits of noise levels) are then worked out and enacted later, usually in the form of Durchfuhrungsvorschriften (orders). These specific regulations of the Federal Government can often be adapted to changing conditions without altering the law itself. Because of this, some laws have been enacted, but not all of their specific regulations have been put into practice. Some of the latter are currently being subjected to review. (10-66, p 2)

Noise is, of course, not the major environmental health problem in Germany. Nevertheless, it is the major source of annoyance, and polls revealed that about half of the population is affected. According to a recent survey a total of approximately 11.4 billion DM (about 4.4 billion US $) has been spent for environmental protection from 1970 through 1974 by industry and the Federal Government together. Expenditures for noise abatement accounted for 4.3% of that amount. According to the same study about 8.4% out of an expected total of 17.3 billion Marks will be spent for noise abatement from 1975 through 1979. (10-66, p 14) In other words the sum spent for noise would amount to about 1.7 million DM. This figure is confirmed by other sources. (10-72) According to a study of September 1975, prepared by the Battelle Institute, the money invested by the German industry for noise abatement in the years 1970 - 1974 amounted to a total of DM 489,000,000. For the following 5-year period, 1975- 1979, a substantial increase to DM 1,450,000,000 is anticipated. The relative proportion of noise abatement investments in the overall amount invested by the industry for environmental protection is 4.3% and 8.4% respectively. See Table 10-12.

	5-year -period 1970-1974	 1975-1979
Total amount (in DM)	11,370,000,000	17,300,000,000
Relative proportion of this amount for:		
Water pollution control	43.8 %	34.7 %
Ground water protection	7.0 %	2.9 %
Air pollution control	41.0 %	46.8 %
Waste removal	3.9 %	7.2 %
Noise abatement	4.3 %	8.4 %
Total	100.0 %	100.0 %

Table 10-12. Investments for Environmental Protection in the Federal Republic of Germany, 1970 - 1979.

Source: (10-67, p 10-11)

Relationship to the Common Market

Another problem to be tackled in the standardization of noise regulations within the EC countries. It is the desire of FRG to help establish noise abatement standards which are uniform throughout the Common Market states and which also represent the best protection possible at a reasonable expense to the public. This is not an easy task since the overall level of noise pollution, the attitude of the people toward noise, and the measures already taken, are different between the individual EC countries. (10-66, p 15)

Institutional Information - National

The Bundesministerium des Innern (Dept. of the Interior) is in charge of environmental protection in general. Yet responsibility for noise abatement and control is not centralized in this country. Although the Umweltbundesamt, as an agency of the Bundesministerium des Innern, carries the major portion of the burden, other Bundesministerien (Departments) are also active in regulating noise in their jurisdiction: Bundesministerium fur Arbeit und Sozialordnung (Labor), Bundesministerium fur Verkehr (Traffic), Bundesministerium fur Raumordnung, Bauwesen und Staedtebau (Housing and Urban Development), Bundesministerium der Verteidigung (Defense). There is no centralized coordinating agency in the field of noise control. Research related to noise is being organized and financed by all of the Departments mentioned, plus the Bundesministerium fur Jugend, Familie und Gesundheit (Health), and the Bundesministerium fur Forschung und Technologie (Research and Development). (10-66, p 12)

10.11.3.2 Institutional Data (other than regulatory)

Besides the regulations of the government, there are a great number of standards related to all aspects of noise. They are established by Deutsches Institut fur Normung (DIN). Although the recommendations of DIN (German Standards Institution) are not legally binding, they nevertheless command much authority. DIN is therefore similar to ANSI in the U.S. There is another organization, the Verein Deutscher Ingenieure (VDI), which establishes some sort of technical guidelines, called VDI-Richlinien. A number of Richlinien of this organization (Society of German Engineers) are also concerned with noise. They, too, are not legally binding. (10-66, p 3) Then there is the Technischer (Uberwachungsverein (TUV). This semi-official organization (Technical Inspectorate) conducts tests of the safety and performance of all kinds of appliances and machines up to large industrial units. (In most of the states the TUV is authorized to test the safety of all motor vehicles every other year.) It also conducts research in the area of noise abatement. In general acoustics, there is the Deutsche Arbeitsgeminschaft fur Akustik (DAGA), which is the equivalent of the American Society of Acousticians in this country. (10-66, p 12)

Besides these large organizations there is, of course, a vast array of minor ones. A list of addresses will be included in the appendix. Representatives of the government are members of the various international organizations and committees. There is no leading research center in the field for studying effects of noise on man comparable to, say, the Kresge Hearing Research Institute in the U.S. A comparable institution to the Deafness Foundation in the U.S. does not exist on the national level in this country (10-66, p 12)

Some Research Interests

The L_r (rating level) is generally used to describe the noise level of a certain locality because it is recognized that the number of the L_{eq} is often too low to evaluate the impact of noise on the population. Hence a number of research projects have been initiated to elucidate the influence of pure-tone components of noise, of varying noise levels, and pulses as well as other characteristics that may affect the reaction of the people. For everyday practice it is difficult, however, to find a solution which is both simple and scientifically accurate enough. For the forthcoming traffic noise regulation the procedure to be applied is not yet decided; our proposal is to evaluate the noise differently for three main time spans of the day: there shall be 12 hours of day-time, 8 hours of night-time, and 4 hours of morning-evening time. The plans call for an L_{eq} for each of these time-bands and it shall be ordered that all three criteria be met. It is also intended to set an upper limit for the ratio of peak values to the average value in order to be able to prohibit the highly disturbing short bursts of high noise levels which do not raise the L_{eq} sufficiently. An L_{dn}, as proposed in the U.S., is not in use in Germany. (10-66, p 14-15) A proposed L_r, 24th, which differs from L_{dn} especially by the number for the night penalty, is included with the draft DIN 45645.

Another basic requirement is the availability of a valid noise rating scheme which on the one hand, can be applied to all different types of noise (continuous, intermittent, or impulsive noise; "white" noise, or noise containing distinct frequencies, i.e. tone components; sound as a carrier of unwanted information etc.), and which on the other hand sufficiently correlates with the different health and welfare effects caused by this noise in the public.

The Federal Government initiated comprehensive programs of studies coordinated between medical, social, and natural sciences, early in the 1970's and since then put special emphasis on carring on these and related investigations. A very substantial amount of R&D is also carried out under federal auspices in studies of the state of (technical) art in noise suppression technology and in the development of new technologies with emphasis on noise reduction. During more than ten years of intense efforts, West Germany, perhaps motivated earlier and more urgently than many other countries by its high population density and its high degree of industrialization, has developed successful concepts of noise abatement policies on a national basis, especially in the fields of industrial noise, construction noise, and airport noise. (10-66, p 4)

10.12 Netherlands

A steadily increasing concern for noise abatement is witnessed in the Netherlands both at political and administrative levels. This concern and awareness on the part of the Netherlands is expressed in the recent legislative proposals to control noise problems.

10.12.1 National Laws, Regulations, and Guidelines

There are provisions aimed at noise abatement in a number of Acts and Decrees. However, these provisions are usually secondary compared to the main purpose of the regulations. At present the most important provisions dealing with noise are found in the Nuisance Act of 1952, the Industrial Safety Act 1934, Dangerous Instrument Act, Road Traffic Act and the Aviation Act of 1958 in addition to other regulations. No legal provisions exist for construction noise, noise from appliances in general, railway noise, or the prevention of noise problems in planning procedures.

Recently two bills have been submitted to Parliament: the Noise Abatement Bill 1975 and a bill to amend the Aviation Act.

10.12.1.1 Occupational

The Industrial Safety Act gives rules for industrial safety and health in cases of harmful noise, the Act gives rules as to the prevention or restriction, and to the time during which workers are allowed to remain in a location associated with excessive noise.

Provisions in support of these rules are presently being prepared for various industrial sectors. (10-75) In the Industrial Safety Decree for factories or workshops there is a regulation concerning the wearing of ear plugs. (10-75)

In addition to the provisions of the Industrial Safety Act, emission standards for certain categories of machines are made in the interest of their users under the Dangerous Instrument Act.

10.12.1.2 Emission Limits -existing products

Motor Vehicle Noise, Railroad Noise

Implementary regulations to the Road Traffic Act have been issued. Namely, Road Traffic Regulations and Traffic Rules and Signs Regulations contain provisions which aim at noise abatement.

In sections 66 and 80(a) of the Road Traffic Regulations, it is stipulated that the exhaust systems of motor vehicles and mopeds must be fitted with a proper silencer and that they are not allowed to produce noise above a certain level. This maximum level was established by the Minister of Transport and Public Works on May 27, 1971 with conditions and means of measurement. The levels for vehicles are in accordance with the Common Market Directive 70/157.

Railroad noise has, until recent years, not received much attention in the Netherlands. However, as new railroads are being planned, and as urbanization and suburbanization result in buildings being closer to railroad tracks, railroad noise is a growing concern.

In 1973, a Road Traffic Noise Research Program was started, to be followed in 1975 by a Railroad Noise Research Program.

10.12.1.3 Emission Limits -new products

Emission limits for new products such as construction equipment, domestic appliances and recreational vehicles will be set under the Noise Abatement Act.

10.12.1.4 Zoning Approaches

The main development in this area has been the introduction of the Noise Abatement Bill (1975) which contains the legal framework for noise zones around industrial estates, alongside roads and other zones. The size of the noise zone will have to be such that outside this zone the noise from the estate itself is not more than 50 dBA in the daytime or 40 dBA at night. For heavy industry and dense traffic arteries this results in noise zones being several hundred meters in width. Within the zones, statutory limits will apply for the permissible noise near dwellings and other noise-sensitive objects. When developing new housing areas within such zones or when developing new industrial sites or roads, the Bill requires an acoustical investigation and proof that the limits will be respected.

The width of noise zones alongside roads depends upon the number of lanes, the location of the roads and the intensity of traffic.

Airports

The Aviation Act of 1958 and noise abatement regulations based on this Act presently form the legal basis for aviation noise control. Implementary measures, namely Air Traffic Regulations and the the Regulations for Air Navigation Control, issued in 1971 and 1972 make it possible to take measures in the technical and operational sectors. Moreover, supersonic flights are not allowed over the Netherlands.

Other measures of aircraft noise abatement include noise-optimized flight routes, a preferential runway use system at Schiphol Airport and night-flight limitations at all major airports. Supersonic flight over the Netherlands is forbidden by law for civil aviation. (10-76)

An amendment to the Aviation Act, making it possible to establish noise zones around airfields, was presented to the Parliament in October 1974. (10-76)

The extent of the aircraft noise problem is assessed by computing the noise contours around all existing airfields and by subsequently computing the number of houses, schools, hospitals, etc. within these contours.

10.12.1.5 Other National Measures in the Legal Framework

In the last two years the Department of Public Health and Environmental Protection has carried out a preliminary Noise Abatement Program which was formulated in 1972. (10-76) Main items include:

1. The drafting of a Noise Abatement Bill of 1975.
2. Preparation and initiation of an overall noise research program.
3. Preparation for noise zoning around airfields.
4. Recommendation of permissible noise limits for provincial and municipal executives.
5. Application of noise standards to road and new-town design.

10.12.2 Provincial and Local Legal Framework

10.12.3 Enforcement and Institutional Data

10.12.3.1 Enforcement

10.12.3.2 Institutional Data

10.13 United Kingdom

In the United Kingdom, the most widespread source of environmental noise problems is transport, particularly road and air traffic. It is generally realized, by both the public and the central government, that noise-related law is unacceptably weak and particularly that statutory legislation is inadequate. (10-77, p 28-30)

10.13.1 National Laws, Regulations, and Guidelines

The body of law concerning noise in the United Kingdom is of three basic types: 1) a substantial body of case law and precedent concerning noise as a form of common law nuisance; 2) the Noise Abatement Act; and 3) other statutes and regulations dealing with different noise aspects.

The Noise Abatement Act of 1960 is the only parliamental act specifically designed for control of noise. This act in its first subsection of Section 1 states: "noise or vibration which is a nuisance shall be a statutory nuisance for the purpose of Part III of the Public Health Act, 1963.

Apart from the Noise Abatement Act, provisions dealing or relating to noise are found in different statutes and regulations but do not stand as the main purpose of the topic legislation among which are the Public Health (Recurring Nuisances) Act 1969, Control of Pollution Act 1974, Land Compensation Act 1973, Motor Vehicles (Construction and Use) Regulations, as amended 1973 and 1974, Noise Insulation Regulations 1973, and Town and Country Planning Act 1971.

The introduction of noise abatement zones pursuant to the Control of Pollution Act marks a major change in the legal philosophy of controlling noise, and stands as an important development in present time. (10-78)

10.13.1.1 Occupational

The Factories Act of 1961 states that every workplace should be safe for employees: its applicability to noise is not clear, and only very few common law actions on noise-induced hearing loss have been successful at the present time. (10-79) A more important and recent legislation for noise control in the work place is the Health and Safety at Work Act which became law on April 1, 1976. This Act places a general duty on employers to ensure, as far as is reasonably practicable, the health and safety and welfare at work of their employees. The Act, in common with the Factories Act, 1961, does not refer specifically to noise, but obliges employers to provide and maintain a working environment for their employees that is, so far as is reasonably practicable, safe and without risks to health. It is of interest to note that the Factories Act, 1961 covered only those persons employed in factories as defined in the Act, whereas the Health and Safety at Work etc. Act extends to all persons at work (self-employed included).

Legal remedies concerning noise problems are generally in the form of injunction and damage suits in a common law action. A case in which a worker who was exposed to extreme noise and thereby sued his employer for damages in respect to occupational hearing loss has occurred only in the last few years. Usually there are three factors which must be proven for a successful case: 1) that the medical diagnosis of deafness has to be shown to be noise-induced; 2) that the hearing loss has to be shown to be causally-related to the alleged industrial noise exposure; and 3) that the employer must be proven negligent in recognizing the noise hazard and therefore taking appropriate measures to prevent worker hearing damage . (10-79)

The British Department of Employment, concerned about noise-induced hearing loss published a Code of Practice (1972) which was drawn up by the Subcommittee on Noise of the Industrial Health Advisory Committee. This Code recommends that workers not consistently be exposed to a noise level higher than 90 dBA over an eight hour period. (10-85)

A United Kingdom milestone in the field of hearing conservation was reached in November 1974 with the coming into operation, under the Factories Act, 1961, of the Woodworking Machines Regulations. Regulation 44 (the first ever on hazardous occupational noise) places on employers in that industry an obligation to reduce noise in excess of the limits specified in the "exposure code" by reasonably practicable measures and to make ear protectors readily available to workers. It also places on noise-exposed workers the responsibility to use the protection provided.

At present, the only recent United Kingdom laws to impose noise limits in the workplace are those which refer solely to wood-working shops. There is however, the cited general requirement that employers provide a safe and healthy working environment, and forthcoming legislation along the lines of the Code of Practice is expected to be introduced during 1976. (10-80)

10.13.1.2 Emission Limits-existing products

Motor Vehicle Noise

In the United Kingdom, road traffic noise disturbs more people than any other forms of noise nuisance combined. (10-78)

The Motor Vehicles (Construction and Use) Regulations 1968 and its subsequent amendments, S.1.1973 No. 1347 and S.1.1974 No. 765, contain both a general prohibition of excessive noise, and specific noise limits for different classes of vehicles. The regulations deal also with vehicles in use before April 1970, for which there are separate and lower limitations set. (10-78P) Regulation 21 requires audible warning instruments, yet bans gongs, bells, sirens, two-toned horns, and Section 27 stipulates a silencer for reducing exhaust noise as far as may be reasonable. Regulation 23 prescribes the procedure and the method of noise testing and sets the dBA level requirement for cars first used before April 1, 1970. Regulation 88 forbids excessive noise from motor vehicles which could have been avoided by the exercise of reasonable care on the part of the driver.

Aircraft Noise

Following the Montreal meeting of the ICAO in November 1969, the Air Navigation (Noise Certification) Order of 1970 stipulated that as of January 1971, all new subsonic jet aircraft operating in the United Kingdom must reduce their noise levels within 50% of current jet aircraft of the same weight. New models of the older makes manufactured after January 1, 1976 would also be required to conform to the noise standards.

In addition to aircraft certification as a means of freeing the environment from aircraft noise nuisance, the government has received comprehensive powers in the Civl Aviation Act of 1971 for noise control monitoring and enforcement at any airport in the United Kingdom. Consequently, a complex set of noise regulations and limitations has been issued. Most airports in the United Kingdom have specific noise limits and monitoring schemes for take-offs, landings, and other operational measures. (10-78F7/5)

The Endurance Flight Trials of Concorde showed a significant number of infringements on the noise limits at London (Heathrow) Airport. Valuable experience was gained during these flights and further analysis of all the noise data is now being undertaken by the manufacturers who seem confident of more technical refinement and improvement in regard to noise reduction. (10-80)

10.13.1.3 Emission Limits-existing products

10.13.1.4 Zoning Approaches

The Control of Pollution Act (1974) contains the recent legal framework for the establishment and operation of Noise Abatement Zones. Local authorities in mixed industrial and residential areas are authorized to declare an area as a Noise Abatement Zone, with confirmation of the Secretary of State for the Environment. This action is followed by a noise survey in accordance with established guidelines, and results are open to the public to give the zone occupants a chance of appealing.

The purposes of this zoning approach are two-fold: prevention of an increase in the general noise level in a zone, and reduction of the general noise level.

Specific guidelines, drawn up under the Town and Country Planning Act (1972) and the Building Regulations Act (1972), were issued in a Department of the Environment Circular entitled "Planning and Noise 1973". The guidelines recommend that planning authorities consider noise limits and noise insulation, i.e., walls and floors, as a factor in all proposed building and development. (10-81)

10.13.1.5 Other National Measures in the Legal Framework

1) The Land Compensation Act of 1972 laid the basis for compensating property owners where the value of such property had depreciated due to a noise element excluding airfields. That is, a house or a property owner, subjected to an increase in road traffic noise of a level of 68 dBA (L_{10}) or more, as a result of a new or improved road, is entitled to funds for sound insulation provided by in accordance with the Noise Insulation Regulations of 1973.

Deadlines are stipulated by the Land Compensation Act so that highway authorities are obligated to publish lists of addresses, and to offer the home insulation program to eligible households that are affected by traffic noise. All highway improvements which were opened to traffic or completed after October 16, 1972 must be assessed for noise nuisance in order to compensate eligible residents of highway-adjacent areas. (10-82)

Insofar as the geographical distribution of areas eligible for the compensation program, several airports in the United Kingdom, including London's Heathrow and Gatwick, Manchester Ringway and Luton, have programs for payment of grants to households subjected to a certain high level of aircraft noise.

2) In 1972, the Department of Employment issued the "Code of Practice for Reducing the Exposure of Employed Persons to Noise", a voluntary document which recommends that where workers are likely to be exposed to sound levels over 90 dBA for eight hours per day (or to suffer an equivalent exposure), action should be taken to reduce the noise exposure, and to ensure that ear protection is provided and used. It also recommended the surveying of noisy areas and the marking of workplaces where the recommended noise levels wer exceeded.

3) At the request of the Government, the Noise Sub-Committee of the Industrial Health Advisory Committee, having studied (inter alia) figures on the implementation of the Code of Practice supplied by HM Factory Inspectorate, produced a report "Framing Noise Legislation" which considers the problems involved in, and gives the Sub-Committee's recommendations on occupational noise legislation. The report was widely circulated for comment in November 1975, and it is confidently expected that noise legislation, based on its recommendations, will follow. (10-83)

10.13.2 Provincial & Local Legal Framework

10.13.3 Enforcement and Institutional Data

An important development for future motor vehicle noise control in the United Kingdom is the forthcoming compulsory 'type-approval' scheme which will require that at production a vehicle of each new make, be tested in several aspects, including noise. The manufacturer will be required to certify that every individual vehicle conforms to the approved type and will be subjected to random governmental checks. The first stage of this proposed standard, scheduled to begin in 1977, will pertain to passenger cars only but wil later extend to include goods, vehicles and motorcycles. (10-80)

10.13.3.1 Enforcement

There are two basic methods of enforcement in the UK, occupational noise standards are enforced through the Factory Inspectorate this is a central government organization. Environmental noise standards are the responsibility of local government authorities and enforcement is through the Environmental Health Departments, and District Councils. The majority of these Councils now have environmental noise offices and environmental noise control is one of their responsibilities. Another aspect of enforcement is planning control, minor planning projects, say less than £100,000* are under the control of the County or Metropolitan Borrough Councils, whereas major construction projects require a system of public enquiry organized by the Department of the Environment. These enquiries are carried out by an inspector who acts in a quasi-judicial manner, taking evidence from all sides and making a recommendation to the Minister. (10-84) Procedures and remedies for noise control problems under both the Common Law and the different Statutes and acts have been drawn in Figure 10-2.

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* approximately $177,000 U.S.

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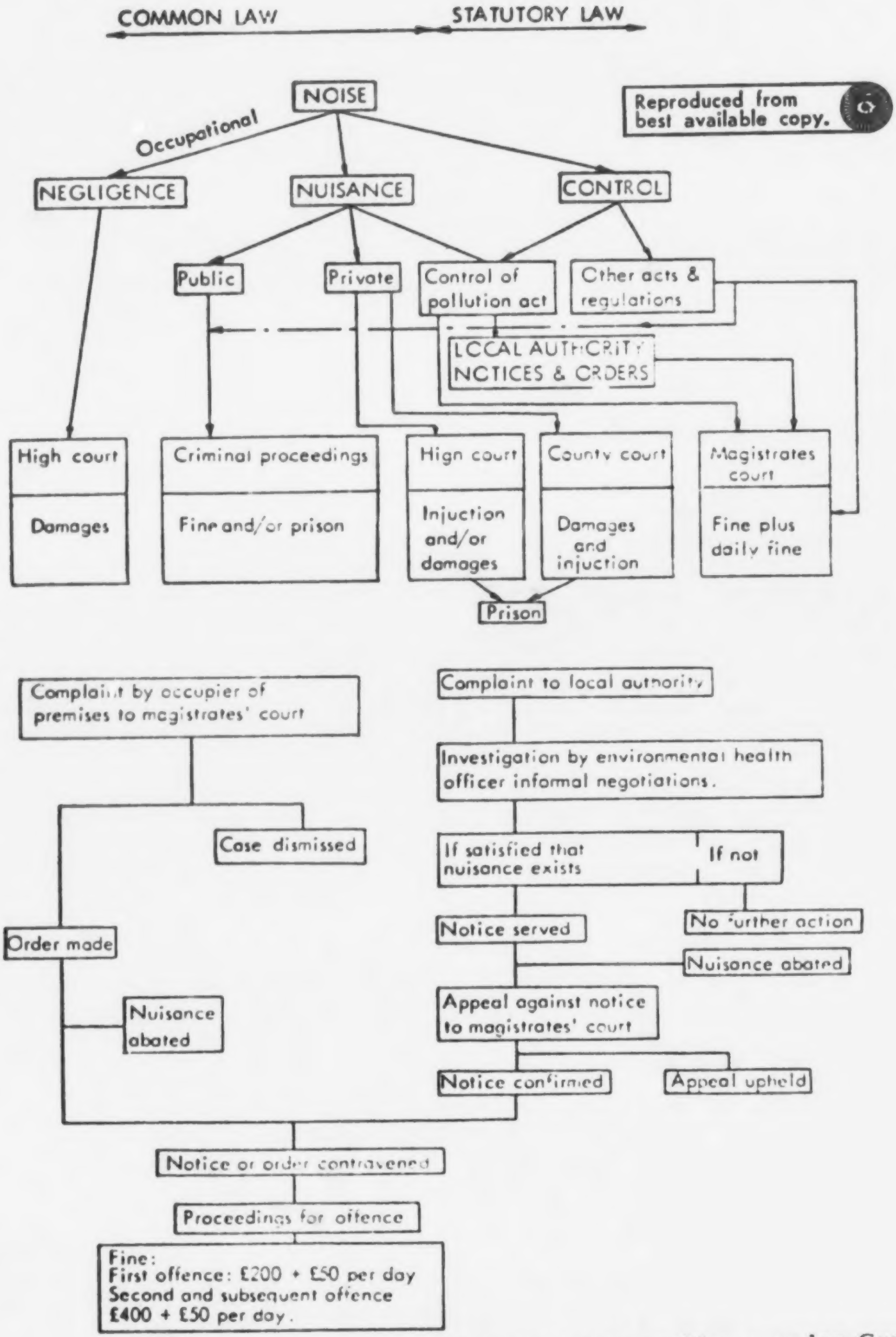
COMMON LAW
STATUTORY LAW
NOISE
Occupational
NEGLIGENCE
NUISANCE
CONTROL
Public
Private
Control of pollution act
Other acts & regulations
LOCAL AUTHORITY NOTICES & ORDERS
High court
Damages
Criminal proceedings
Fine and/or prison
High court
Injuction and/or damages
County court
Damages and injuction
Magistrates court
Fine plus daily fine
Prison
Complaint by occupier of premises to magistrates' court
Case dismissed
Order made
Nuisance abated
Complaint to local authority
Investigation by environmental health officer informal negotiations.
If satisfied that nuisance exists
If not
No further action
Notice served
Nuisance abated
Appeal against notice to magistrates' court
Notice confirmed
Appeal upheld
Notice or order contravened
Proceedings for offence
Fine:
First offence: £200 + £50 per day
Second and subsequent offence
£400 + £50 per day.

Figure 10-2 Procedures and remedies for noise problems under Common Law and Statutory Law in the United Kingdom.
Source: (10-85)

10.14 Israel

Noise is considered an important problem because of the warm climate (open windows, sitting outside, open terrances).

10.14.1 National Laws, Regulations and Guidelines

10.14.1.1 Occupational

There is a voluntary guideline of 85 dBA for a 45-hour week. There are no requirements for factories to issue ear plugs or for audiometric testing, but audiometric testing is generally carried out annually. Some audiometric testing is done in the army, which most Israeli citizens have been in at one time or another. Noise induced hearing loss is compensable in Israel, but few factories have noise control programs and most still ignore the problem. (10-87)

There is a Ministry of Transport requlation of 1972 ("Hindrance of Hazardous Noise on Ships") limiting exposure for eith hours to the I.S.O. NC80 curve, or about 85 dBA. (10-88)

10.14.1.2 Emissions Limits -- Existing Products

Little has been done. A committee has been set up to prepare standards for permitted noise standards for construction equipment. (10-89)

10.14.1.3 Emissions Limits -- New Products

The Ministry of Transport has agreed to adopt the European Economic Community's Standard for permitted noise standard for new vehicles.(10-89)

10.14.1.4 Zoning Approaches

The Law "Abatement of Public Nusiance--Noise" of 1973 was passed but is not yet in force because it was not signed. (Table 10-13) It provides for zoning limits to noise as measured inside buildings with all windows open, since Israel has an 'open windows' environment and little air conditioning. It does not apply to noise from aircraft or road traffic. (10-90) Control of noise from factories is done under the liberal provisions of the Licensing of Businesses Law and the Abatement of Nuisances Law. Both of these laws prohibit unreasonable noise pollution-neither define this term. (10-89)

10.14.1.5 Other National Measures

In school construction the Board of Education consults acousticians to develop noise criteria and to check to see that noise specifications in new construction are met. Noise control is one aspect of the plans for a new 2,500-student high school which will cost four to five million dollars.

A "blue-ribbon" committee of experts has prepared standards for community noise levels based on permitted noise levels inside schools, factories, rest homes, hospitals and private homes. A strategy for the implementation of the community noise standards is also being prepared. In addition a committee of experts has been set up to prepare standards for acoustical designs of buildings and maximum permitted noise levels from heavy building equipment. Quite a number of cities and small towns are affected by Israel's three international airports: near Lod, Jerusalem and Eilat and by numerous landing strips scattered throughout the country. These are used by commercial and military aircraft alike. Although there is no monitoring of the effects of noise on people near the airports, near one airport (near the town of Kfar Shermayahu) there are existing curfews for warming up and take off.

Work is being done on the development of a quiet aircraft. Licensing of aircraft is in accordance with F.A.A.-36 I.C.A.O.-16.

In the past two years work has been centred on the preparation of noise contours around Ben Qurion Airport, definition of building limitation, acoustic materials and utilization of land around the airport as part of a national plan for airports is being prepared for the National Planning Council. (10-89)

10.14.2 Provincial and Local

Ther are no organized city or regional programmes. There are laws against ureasonable noise and unnecessary honking of horns. These are generally not enforced. (10-89) One rare example of local action was an earth berm erected on the road entering Ramat-gan for noise control and esthetic purposes. (10-87)

10.14.3 Enforcement and Institutional Data

There is very little enforcement of existing legislation. (10-89) Since the environmental noise law was passed in 1973, it has been used as a guideline but it has not been signed, the delay being caused by economic considerations connected with the recent war. When there is a complaint of noise nuisance, both the creator of the noise and the complainer may be asked by the judge to supply noise measurement data. These data are compared to the guidelines by the judge and may be used by him in reaching a decision. It is expected that the law will be signed in 1976, and then the judge must follow it.

The effectiveness of the law is limited by its partial scope. It does not cover noise from road traffic or from aircraft. Thus it represents an approach which concentrates on maintaining quiet against other sources (factories, etc.) in areas which are not already impacted by the more intractable types of noise source.

The Ministry of Health has done some work in proposing noise guidelines. The development of the noise limits for merchant ships, including the taking of noise survey measurements, was done by the Department of Shipping and Harbours of the Ministry of Transportation. (10-87)

The Ministries of Health and Interior are jointly responsible for the regulations of permitted noise levels with the exception of occupational noise which is the responsibility of the Ministry of Labour. Co-ordination of government activity is done by the Environmental Protection Service.

There is no trend in Israel towards creating a unified Environmental Ministry; instead a multi-disciplinary body was set up to co-ordinate activity in the environmental field. (10-89)

Part a

Zone	Noise Level [dB(A)] day *	 night **
(1)	(2)	(3)
Quiet	45	35
Primarily Residential	50	40
Mixed Industry	55	40
(a) In Vital Dwelling Apartments	55	40
(b) In Other Dwelling Apartments	-	-
(c) In Neighboring Industry	70	70

Part b

				Industry	
	Quiet Zone	Primarily Resid.	Mixed Zone	Vital Dwelling	Neighbor. Industry
(1)	(2)	(3)	(4)	(5)	(6)
1 more than 9 hours	45	50	55	55	70
2 more than 3 hours but less than 9 hours	50	55	60	60	75
3 more than 1 hour but less than 3 hours	55	60	65	65	80
4 more than 15 minutes but less than 1 hour	60	65	70	70	85
5 more than 5 minutes but less than 15 min.	65	70	75	75	90
6 more than 2 min. but less than 5 min.	70	75	80	80	95
7 not more than 2 min.	75	80	85	85	100

Table 10-13. Israeli Community Noise Law (other than aircraft or traffic noise)

* day - 0600 - 2200.

** night - 2201 - 0559.

Notes to Table 10-13

Zone - As defined by the Building and Planning Law-1965 which designates land for various purposes.

Quiet Area - Land designated for any one of the following purposes: hospital, rest houses, hotels in recreation area.

Mixed Zone - Land used for dwelling as well as for one of the purposes outlined: commerce, handcraft, entertainment and heavy traffic where the following will not be included: land in quiet zone, primarily residential and industrial.

Steady Noise - Noise that the measurement of its level within 15 continuous minutes does not show a difference of more than 10 dB(A) between the maximum and the minimum level readings.

Equivalent Level - Noise level computed by the equation (1) as:

$$L_{eq} = 10 \log \left(\frac{1}{10} \sum si \; 10 \; \frac{Li}{10}\right) \text{ in dBA}$$

Unreasonable Noise - For the purpose of the law, each one of the following will be considered as unreasonable noise:

(a) Noise that is continuous throughout the day and its level is higher than the value given in Column 2 of Appendix Part a. This with reference to the Zone as stated in Column 1.

(b) A noise that does not continue through the day, but its level is higher than the values per day as given in rows 1 to 7 in part b. of Appendix 1. This with reference to the Zone as stated in Columns 2 to 6.

(c) A noise that continues any period of time during the night, and its level exceeds the value given in Column 3 part a. of Appendix 1 referring to the Zone stated in Column 1.

Steady and Varying Noise - For the purpose of this regulation, noise level is defined as:

(a) In case of Steady Noise - the arithmetic average of the measured noise levels.

(b) In case of Varying Noise - the equivalent noise level.

Notes to Table 10-13, continued

Method of Measurement and its Conditions

(a) The measurement will be carried out:

  (1) In dwelling apartments - in dwelling rooms and in bedrooms.
  (2) A place that is not a dwelling apartment - in rooms where people stay constantly.

(b) The measurement will be carried out in the following conditions:

  (1) In the middle of the room, and at least 1 meter away from any wall or obstalces.
  (2) At a height of 120 cm. - 150 cm. from the floor.
  (3) With all windows widely open and room doors closed.
  (4) The microphone will be directed in such a way that maximum level readings will be obtained.

(c) (1) The measurement of noise level for the purpose of determining whether the noise is steady or varying will be done with the meter set on "slow".
  (2) The measurement of the steady level will be done with the meter set on "slow".
  (3) The measurement of the varying noise level will be done at the following conditions: (i) meter set on "fast" (ii) time interval between 2 measurements should be more than 1 second and less than 5 seconds (iii) time of measurement should enable 500 continuous measurements at least.

10.15 Italy*

In Italy, as in many other countries, the meaning of noise in the legal sense, is the traditional and limited one of causing annoyance or personal disturbance instead of causing pollution of the environment. However, this problem is receiving more attention because of the constantly increasing number of noise sources. (10-91)

National Laws and Regulations

Italy has not yet enacted a special law dealing solely with the noise control issue. However, articles dealing with noise do exist in some legal codes. In addition, in August 1971 as a member of the Common Market, Italy adopted the EEC Directive dealing with maximum vehicle noise emissions.

National laws include Art. 659 ("Codice della Strada") of the Penal Code, which provides penalties of up to three months imprisonment for making noise which disturbs sleep. This law falls into the category of those laws concerning the disturbance of peace, and has been used relatively little with respect to noise. A second national law includes Art. 844 of the civil code which provides a scope for civil suits to alleviate noise nuisance from neighboring dwellings.

Of particular importance are some articles contained in the Highway Code (Articles 46, 47, 55, 112, 113 and 215) which deal mainly with noise emitted from motor vehicles. These articles specify noise level limits regarding motor vehicle operation, equipment, and inspection. Finally, permissible noise level limits for machines or engines have been prescribed by law. Articles 214 and 215 of the of the Presidential Decree, No. 420 of 1952 establish the permissible noise levels for engines and the procedure for ascertaining their levels. The maximum noise levels are 90-98 dBA at a distance of 7 meters for agricultural machinery, but levels are not yet specified for construction equipment. (10-92)

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* Information about noise control in this country has been scarce and limited to this brief overview.

10.16 Japan

The extent of high density of noise pollution in Japan is expressed in the fact that one third of the pollution complaints are related to noise problems. Being an advanced industrial country, nearly half of the noise complaints involve noise from industry. (10-93, p. 720)

10.16.1 National Laws, Regulations and Guidelines

Noise pollution from industrial installations, contruction works and motor vehicles in Japan is regulated or controlled by the Noise Regulation Law No. 98 of 1968 and the Basic Law for Environmental Pollution Control No. 132 of 1967. These two Laws laid down the comprehensive legal framework of noise control from different sources and also contained regulations about certain specifications, levels and penalties. Enforcement cabinet orders pursuant to these laws were issued.

Environmental quality standards for noise were established in May 1971 for various categories of areas. A separate set of standards has been issued for aircraft noise in December of 1973. In July of 1975, separate sets of standards for Shinkansen Superexpress Line noise were established.

10.16.1.1 Occupational

Occupational noise limits are now officially 100 dB. The prospects for the future indicate that it is unlikely that the official limit will be tightened soon, although industry guidelines are now set at 90 dBA. Whatever progress is made will come through voluntary industry actions as a result of efforts by the Japan Industrial Hygiene Association. (10-94)

10.16.1.2 Emission Limits-existing products

Motor Vehicle Noise

The Law No. 185 of 1951 specifies that no motor vehicle shall be operated if it produces noise emissions exceeding:

- o 85 dBA as measured 7 meters to the left of the longitudinal axis of the vehicle when a motor vehicle is running on a level road at a speed of 35 Km/h (or in the case of a motor vehicle for which the maximum speed is less than 35 Km/h, at 60% of its maximum power).
- o 85 dBA as measured at a point 20 meters to the rear of the exhaust pipe when a motor vehicle is running unloaded at 60% of its maximum power.

All motor vehicles shall be equipped with a muffler in good working order.

Railroad Noise

For existing express railroads (Shinkansen), there are no legal limits but there is a program and target future limits. (Table 10-14)

Zonal Classification of land adjacent to Railroad			Target Periods for Achievement		
			Existing Line	Lines Under Construction	Future Lines
A	Areas exceeding 80 dBA		in 3 years	on start of service	From Start of Service
B	Areas ranging between 75 and 80 dBA	a	in 7 years	in 3 years after inauguration	
		b	in 10 years		
C	Areas ranging between 70 and 75 dBA		in 10 years	in 5 years after inauguration	

Table 10-14. Target Schedule for Abating Noise from New and existing Shinkansen Express Railroad Lines.

Source: Private Communication, Director of Air Quality Bureau, Japan Environment Agency to Informatics Inc. August 9, 1976, p. 8-22.

10.16.1.3 Emission Limits-new products
Motor Vehicle Noise

Standards for new motor vehicles have been issued pursuant to Article 16 of the Noise Regulation Law and have been in force for new vehicles since April 1971, and older vehicles already on the road have conformed to them since 1972.

In an attempt to tighten motor vehicle emissions standards, new standards were issued in September 1975, to be enforced from January 1976 partially and by September 1976 completely. (Table 10-15)

Classes of Motor Vehicle	Maximum Allowable Limits dBA	
	Acceleration*	
	Existing	New
Medium, small and mini cars, and motor bicycles		
Medium, small and mini cars (except motor bicycles and passenger cars with a capacity of less than 10 persons):		
3.5 tons or more and 200 HP or more	92	89
3.5 tons or more and 200 HP or less	89	87
3.5 tons or less	85	83
Passenger cars with a capacity of less than 10 persons	84	82
Two-wheeled small cars	86	83
Two-wheeled mini cars	84	83
Class 1 motor bicycles	80	79
Class 2 motor bicycles	82	79
Motorcycles under 250 cc	84	83
Motorcycles over 250 cc	86	83

*Acceleration test at 7.5 meters

Table 10-15. Noise Standards for New Motor Vehicles

Sources: (10-93, p. 725; 10-94)

10.16.1.4 Zoning Approaches

Aircraft Noise

The basic noise abatement law on aviation is known as the Aircraft Noise Prevention Law of August 1, 1967, No. 110. The September 7, 1967 Cabinet Order No. 284 sets standards for aircraft noise control.

One of the features of Law No. 110 is that the areas surrounding specific airports are divided into three sub-areas for abatement purposes, according to the levels of aircraft noise, as reported by the Noise Abatement Division-Ministry of Transportation of Japan in a "Report on Countermeasures Against Civil Aircraft Noises in Japan, Sept. 1973". Table 10-16.

Zone	Aircraft noise contour	Measures
One	85 WECPNL or more than	Sound-proofing
Two	90 " "	Replacing the house
Three	95 " "	Purchasing the land as buffer zone

Table 10-16. Measures to be taken at Specific Airports in Japan.

Based on Article 9 of the Basic Law for Environment Pollution Control, an Environment Agency Notification of December 27, 1973 assigned two main zones of areas around the Japanese airports for land use planning purposes: 70 WECPNL or less, and 75 WECPNL or less. (10-96, p. 1-5)

Other Sources

Based on Article 9 of the Basic Law For Environmental Pollution Control (Law No. 132, 1967), power was granted to the National Government to take necessary measures for pollution control. The guideline on noise abatement and control was made by the Japanese Cabinet Decision on May 25, 1971. The limits included in this guideline are represented in Table 10-17.

Zones		Daytime	Morning & Evening	Night
AA	Quiet area with hospitals or recuperational facilities	45 or less	40 dB or less	(A) 35 or less
A	Residential area	50 or less	45 dB or less	(A) 40 or less
B	Commercial areas and industrial areas with numerous residential sections	60 or less	55 dB or less	(A) 50 or less

Note 1: Definition of daytime, morning, evening, and night are left to local authorities, within certain limits set by the national law.

Note 2: Average Noise Level

Table 10-17. Environmental Quality Criteria for Noise

Source: (10-93, p. 724)

On top of these basic limits are overlaid less stringent limits for areas within the zones that are imparted by road traffic noise (Table 10-18)

Categories of Areas	Daytime	Morning & Evening	Night
1. A-zone with two lanes (local street)	55 dBA or less	50 dBA or less	45 dBA or less
2. A-zone with more than two lanes	60 dBA or less	55 dBA or less	50 dBA or less
3. B-zone with one or two lanes	65 dBA or less	60 dBA or less	55 dBA or less
4. B-zone with more than two lanes	65 dBA or less	65 dBA or less	60 dBA or less

Table 10-18. Special Environmental Quality Criteria for Noise (Roadside Areas)

Source: (10-93)

Permissible limits for noise from industrial and construction depend on the zone of the adjacent land. (Table 10-19) (Table 10-20)

Zones	Daytime	Morning Evening	Nighttime	Applicable Areas
AA	45-50 dBA	40-45 dBA	40-45 dBA	Areas that particularly requrre preservation quietness to conserve a good environment for dwellings
A	50-60 dBA	45-50 dBA	40-50 dBA	Areas that require preservation of quietness because of serving for residential use
B	60-65 dBa	55-65 dBA	50-55 dBa	Areas where serve concurrently for residential and commercial or industrial use, and where require prevention of noise generation to conserve the living environment of the inhabitants
C	65-70 dBA	60-70 dBA	55-65 dBA	Areas where serve mainly for industrial use, and where require prevention of noise generation to check deterioration of the living environment of the inhabitants

Table 10-19 Restrictive Standards for Specific Factories

Source: (10-93)

Note 1:

The noise level is determined in the following manner:

(1) When there are hardly any fluctuations, the indicated value.

(2) When the fluctuations are cyclical or intermittent and the maximum value is more or less fixed, the average of the maximum values for each fluctuation.

(3) When the fluctuations are irregular and wide, the value exceeded 5 percent of the measured time.

(4) When the fluctuations are cyclical and intermittent and the maximum value is not fixed, the value exceeded 5 percent of the maximum values of each fluctuation

Note 2:

As measured at factory property line.

Enforcement Standards For Construction Noise
Article 14-1 & Article 15-1, Noise Regulation Law

Designated construction noise should not be exceeded as specified below at the site, 30 meters from construction operation premise.

1.	Work which requires pile drivers, pile extractors and pile drivers and extractors	85 dBA
2.	Work which requires reveting hammers	80 dBA
3.	Work which requires rock drills	75 "
4.	Work which requires air compressors	75 "
5.	Operation involving batching plant and/or asphalt plants	75 "

Table 10-20. Restriction Standards for Specific Construction Operations

Source: (10-93)

Enforcement conditions are prescribed according to classification of district, day of week, time zone of a day and duration of operation per day. Special exemption conditions are provided for urgent, emergency and public construction operations.

10.16.1.5 Other National Measures in the Legal Framework

Civil Aviation Control Measures Law and Law for Community Development Aid for Surrounding Areas of Military Base provide compensation schemes, financial aides for relocation and evacuation from designated noise zones and also noise proof construction works for hospitals, schools, nursery institutions and private houses. Joint community facilities for noise protection are also provided. About 20.5 billion yen was allocated for the National Defence Agency and 11 billion yen[*] was allocated for the Airport Special Account schemes for this purpose in the 1973 fiscal year. A Quasi-government corporation was legally organised for Itami Airport and Puknoka Airport area area for execution of those noise defense measures. Aviation fuel tax revenue is ear-marked to finance those costs.

10.16.2 Provincial and Local Legal Framework

10.16.3 Enforcement and Institutional Data

10.16.3.1 Enforcement

Enforcement and implementation of the noise control laws and regulations is the responsibility of the following national Government branches:

Classification	Law	Jurisdiction
1. Environmental	Basic Law For Environmental Pollution Control (Law 132, 1967)	Environment Agency
2. Industrial	Noise Regulation Law (Law 98, 1968)	Environment Agency

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[*] About $71 million)

Classification	Law	Jurisdiction
3. Construction	Noise Regulation Law (Law 98, 1968)	Environment Agency
4. Aviation	Public or Private Airports and Vicinities (Law 110, 1966)	Aviation Bureau Ministry of Transporation
5. Aviation (military)	Special Loss and Indemnity (Law 246, 1953) and Defense Force (Law 135, 1967)	Account Division, Agency for Defense Equipment
6. Automobile	1. Automobile (Law 185, 1951 2. Traffic (Law 105 1960)	1. Highway Transporation Division, Ministry of Transporation 2. Traffic Bureau, National Police Office
7. Broadcasting		Radio Controller's Bureau, Ministry of Postal Service

An overview of enforcement of laws and regulations relating to noise standards and control can be obtained by looking at the number of cases, notifications and files contained in the Environmental Quality Report of 1974 and 1973. In 1973, 96,538 industrial plant notifications were filed; 242 noise improvement advisories were issued; and 9 improvement orders were issued; 25,074 construction operations notifications were filed; and 15 improvement advisories were issued. 12 cases were prosecuted in 1974. (10-93) In this regard it is important also to mention here that the Osaka High Court has recently given a decision on the Osaka Airport case. The case was decided in favor of the plaintiff residents. Consequently, night flight after 9 p.m. has to be banned and government has to pay one million dollars in compensation. (10-97) The case has been moved to the Supreme Court of Japan for a final word.

10.16.3.2 Institutional Data

The following institutions and organizations in Japan provide data and information related to noise problems in Japan (10-94):

JAPANESE RESEARCH ORGANIZATIONS

NAME	ADDRESS & NAME OF HEAD
1. Government Research Institutes	
National Institute of Public Health	1-39 Shibashirogane-dai-cho, Minato-ku, Tokyo: N. Soda (Dr. Y. Osada for noise)
National Institute of Industrial Health	2051 Chukichi-cho, Kitsuki, Kawasaki city, Kanagawa, Prefecture: M. Yamaguchi (T. Miwa for noise)
Government Mechanical Laboratory	4-12 Igusa, Suginamuiku, Tokyo: Y. Ukida
(City of Tokyo gov't) Tokyo Metropolitan Research Inst. for Environmental Protection	2-7-1 Yurakucho, Chiyoda -ku Tokyo 100: T. Shibata (T. Mochizuki for noise).

JAPANESE RESEARCH ORGANIZATIONS

2. Research Institutes (Special cooperation provided by the government)

NAME	ADDRESS & NAME OF HEAD
Railway Technical Research Institute, Japan National Railways	2-180, Hikari-cho, Kokubunjishi, Tokyo: S. Matsuhira
Social & Economic Affairs Research Institute	3-3, Hon-machi, Nihonbashi, Chuo-ku, Tokyo: H. Matsusumi
NHK Labs (Japan Broadcasting Co.)	1-10-11 Kinuta, Setagaya-ku, Tokyo 157: G. Nishinomiya for noise
Traffic Safety and Pollution Control	6-38, Shinkawa Mitaka-shi Tokyo

JAPANESE RESEARCH ORGANIZATIONS

3. Government-supported Research in Universities

NAME	ADDRESS & NAME OF HEAD
Institute of Space & Aeronautical Science, University of Tokyo	856 Komaba-cho, Meguroku, Tokyo: N. Takaki (Prof. J. Igarashi for noise)
Research Laboratory of Precision Machinery & Electronics, Tokyo Institute of Technology	2-12-1, Ookayama, Meguroku, Tokyo: J. Miyoshi
Institute of Scientific & Industrial Research, Osaka University	3-145, Kayama-cho, Higashiasa, Sakai-shi, Osaka-fu; J. Futaguni
Institute of Constitutional Medicine, Kumamoto University	430 Honsho-Machi, Kumamoto -shi, Kumamoto Prefecture: I. Ogata
Institute of Industrial Science, University of Tokyo	7-22-1 Roppongi, Minato-ku Tokyo 106 (M. Yamaguchi for noise)
Dept. of Sanitary Engineering Kyoto University	Yoshida-honmachi, Sakyoku, Kyoto
Dept. of Health, School of Medicine, Mie University	514 174-2-Edobashi-Tsu Mie: Dr. H. Sakamoto
Dept. of Hygiene, School of Medicine, Yamaguchi University	755 Ogushi Ube, Yamaguchi: Prof. G. Oosaki
Dept. of Electrical Engineering, School of Engineering Tohaku University	980 Aobayama, Sendai (Prof. T. Nimura for Noise)
Institute of Electrical Communication, Tohoku University	980 Katahira, Sendai (Prof. T. Nimura and K. Kido for Noise).

JAPANESE RESEARCH ORGANIZATIONS

3. Government-supported Research in Universities

NAME	ADDRESS & NAME OF HEAD
Dept. of Architecture Kobe University	657 Kobe (Prof. Z. Maekawa for Noise)
Dept. of Acoustic Design, Kyushu Institute of Design	815 Minamiku Fukuoka (Prof. O. Kitamura for Noise)

JAPANESE RESEARCH ORGANIZATIONS

4. Non-profit Private Research Institutes

NAME	ADDRESS & NAME OF HEAD
Construction Research Institute	3-2 Oyama-cho, Nadaku Kobeshi: C. Haraguchi
Kobayashi Institute of Physical Research	3-20-41, Higashimoto-machi, Kokubunji-shi, Tokyo: M. Koyasu
Central Institute for Experimental Animals	8-254, Umeguro, Meguro-ku, Tokyo: T. Nomura
Institute for Science of Labor	2-1226 Soshitani, Sedagaya-ku, Tokyo: I. Saito
Japan Automobile Research Institute	1-6-1, Ohte-machi Chiyoda-ku Tokyo

JAPANESE RESEARCH ORGANIZATIONS

NAME	ADDRESS & NAME OF HEAD
5. Private Corporate Research: Construction	
Obhayashigumi Engineering Research Laboratory	640 Shitayadomae, Kiyose-machi, Kitatamagun, Tokyo: K. Inagaki
Kajima Institute of Construction Technology	462 Ueishihara, Chofushi, Tokyo: K. Takeyama (M. Nagatomo for noise)
Research Laboratory, Shimizu Construction Co., Ltd.	2-1, Takara-machi, Chuo-ku, Tokyo: S. Okizu
Taisei Construction Co., Ltd. Technical Research Institute	2-2, Kyobashi Bldg., Kyobashi, Chuo-ku, Tokyo: G. Yokoyama
Iron & Steel	
Hitachi Metal Industries, Ltd. Kuwana Works, Technical Development Section	2, Daifuku, Kuwanashi, Mie Prefecture: I. Matsuyama
Machinery Development Department, Kobe Steel Ltd.	1-36 Wakihama-machi, Fukiaku, Kobe-shi: T. Kameoka
Electrical Machinery	
Hitachi Research Laboratory, Hitachi Ltd.	4026 Omiks, Hisaji-cho, Hitachi-shi, Ibaragi Prefecture: T. Taguchi
General Development Dept. Matsushita Communication & Industry Ltd.	880 Amijima-cho, Minato- Kita-ku, Yokohama-shi: T. Yoshida

JAPANESE RESEARCH ORGANIZATIONS

Private Corporate Research - (Continued)

Motor Vehicles

NAME	ADDRESS & NAME OF HEAD
Engineering Laboratory Nissan Motor Co., Ltd.	1, Natsukima-cho, Yokosuka-shi, Kanagawa Prefecture: K. Ono
Test Laboratories Nissan Motor Co., Ltd.	6-1 Dai Kokucho, Tsurumi-ku, Yokohama 230: J. Sakagami for noise.

Other

NAME	ADDRESS & NAME OF HEAD
Minoru Nagata Acoustic Engineer & Associates	Chatelaine Shinano-machi 402/3, 4 Minami-moto-machi, Shinjuku-ku, Tokyo 160: M. Nagata
Takasago Technical Institute Mitsubishi Heavy Industries, Ltd.	Takasago, Osaka, Japan: K. Akamatsu for noise.

HANDLING NOISE INFORMATION

Name/Address	Type of Information
Bosai Senmon Tosyokan (Special library for City Hazards Control) Tokyo	Publishes annual bibliography including section on noise
Japan Information Center for Science & Technology (Nihon Kagaku Gijutsu Gyoho Center), 2-5-2 Nagata-cho, Chiyoda-ku, Tokyo	Screens the world technical literature and produces Japanese language announcement bulletin with citations and very short descriptive abstracts. Document services. Approx. 10% of citations are Japanese sources.
Library, Kobayasi Institute 3-20-41 Higashimoto-machi Kokubunji-shi, Tokyo MZ 185, Japan	Medium-sized technical library on acoustics, probably the best in Japan
Japan Public Health Assoc. (Nihon Kosyu Eisei Kyokai) 1-29-8 Shinjuku Shinjuku-ku, Tokyo	Publishes annual bibliography on effects of noise on health.
Japan Acoustical Society Ikeda Building 2-7-7 Yoyogi Shibuya-ku, Tokyo	Publishes Japanese language collection of papers from semi-annual meetings; publishes Journal of JAS monthly. Most noise-related papers are in the collections of papers.

10.17 Norway

Noise legislation is presently in the early stages of discussion at the governmental level. (10-99, p. 742) An important development in the last year has been the establishment of an inter-ministry committee to propose actions for noise control.

10.17.1 National Laws, Regulations and Guidelines

Except for different regulations concerning certain aspects of noise problems, no national law to control noise exists at the present time.

10.17.1.1 Occupational

As far as industry is concerned, only qualitative advice is given: "Unnecessary noise should be avoided". (10-99) While there exist no specific regulations concerning noise limit, the Norwegian authorities on occupational health control usually consider, however, levels exceeding an equivalent noise level of 85 dBA as hazardous.(10-100)

10.17.1.2 Emissions Limits-existing products

10.17.1.3 Emissions Limits-new products

Motor Vehicles

The Road Traffic Act empowers authorities to impose restrictions on noise made by motor vehicles. At the present time there are regulations pursuant to this Act for permissible noise levels of motor vehicles certified for the first time in Norway after January 1, 1972 or later. Norway participates in ECE's work in this field and the regulations are in accordance with ECE's recommendations. Prior to these regulations on motor vehicle noise, rules on maximum noise levels for motorcycles were issued. Also, at present, there are noise limits for machines and vehicles purchased by the road authorities. (10-101)

Aircraft Noise

The main development in controlling aircraft noise during the last two years has been the requirement for noise certification of aircraft. This requirement was established by special regulations dealing with this issue. However, details of these regulations for such certification are not available. (10-101)

Other

There is also some proposed legislation not yet in effect.

1. A new product control law is proposed before parliament and will, if it is enacted, give the Ministry of Environment rule-making power.

2. Norwegian State Pollution Control Authority cooperates with Finland, Sweden and Denmark to prepare regulations for industrial equipment. A proposal for movable compressors is completed

10.17.1.4 Zoning Approaches

At major airports zoning, soundproofing of homes, operational procedures of aircraft take-off and landing at night and other measures are taken. However, aircraft noise as a disturbing factor in the environment has been a serious problem. There are cases where housing developments have been located too close to airports.

While there are no immission limits for road traffic noise and no decision has been taken yet to introduce legally binding regulations, the negative effects of road traffic noise have come into focus during the last years.

As far as deciding upon industrial and factory sites is concerned, a legal requirement of obtaining a license is to be met under the terms of the Neighborhood Act. Such a license is granted by Smoke Control Council or in minor cases from the state Pollution Control Authority.

The legal basis for handling noise from factories was established in May 1974, but means of control, measurement or standards are not clear. (10-101)

10.17.1.5 Other National Measures in the Legal Framework

1. An approach to control construction noise was done in Oslo by issuing "Regulations of noise abatement" in October 1975.
   The regulations were issued by Oslo Board of Health, Municipality of Oslo, and approved by The Ministry of Social Affairs.
   All kinds of noise are covered by these regulations, but with special attention on the construction noise.
   The regulations give maximum equivalent SPL in dBA.
   There are different values for "day", "evening" and "night", and for some areas, for summer and winter.
   In the last years these regulations have had an advising function with the result that more silent construction machinery are used, especially in the construction of the underground train system.
   The prospective developments in 1976 are to have similar regulations for the whole country (urban areas). It is the hope of The Ministry of Social Affairs that the regulations, based on the Oslo regulations, will be made operative during this year. (10-100)

2. In August 1969 The Ministry of Labour and Municipal Affairs issued a revised version of the building regulations based on the building law of June 1965.
   This regulation contains requirements on noise inside buildings.

   a. Normalized transmission loss of the construction between apartments.
   b. Sound transmission loss of the construction between apartments.
   c. Doors between apartments and corridors.
   d. Normalized impact sound level between apartments.
   e. Reverberation time in corridors and staircases.
   f. Sound pressure levels in buildings.

3. An inter-ministry committee to evaluate and propose actions for the reduction of noise problems has been established in Norway.

4. The Ministry of Environment will publish a parliamentary report on noise abatement which will draw up guidelines and objectives for further work and action programs.

5. A project currently in progress, aimed at registration of noise levels and location of noise sources in urban areas will give reliable figures. These figures showing the number of people disturbed by road traffic and other sources of noise will be available this year. A better foundation will thus be available for deciding on effective preventive measures for noise problems. (10-101)

6. The worse aircraft noise problems are connected with Fornebu Airport near Oslo. Thus, aircraft operations at night are prohibited at Fornebu between the hours of midnight and 7 a.m.

7. In 1977, there will be enforced an occupational health act which states that harmful noise is prohibited, without mentioning any noise limits.

10.17.2 Provincial and Local Legal Framework

Noise from construction sites in Oslo has been restricted by regulation issued by Oslo Health Council. As for other Norwegian cities, information is not presently available.

10.17.3 Enforcement and Institutional Data

10.17.3.1 Enforcement

The Ministry of Environment, the Inter-Ministry Committee established to propose actions for noise reduction, motor vehicle and aviation authorities, State Pollution Control Authority, Smoke Control Council and local municipal councils are involved in enforcing noise regulations.

A permanent Commission on Aircraft Noise functioning as an advisory body to the Government in all questions involving aircraft noise has been established. This commission is responsible for monitoring noise at all airports and must take the initiatives for noise abatement measures in cases where noise is the cause of environmental disturbances. At some airports, local noise committees have been appointed to handle complaints from the local inhabitants. (10-102)

10.17.3.2 Institutional Data

1. Norwegian Department of Environment Protection
   "Miljoeverndepartementet"
   Myntgaten 2
   Oslo 1, Norway

2. Akustisk Laboratorium
   7034 Trondheim - NTH
   Norway

3. National Institute of Technology
   Acoustic Section, Post Office Box 8116
   Oslo dep. - Oslo 1
   Norway

4. Norges Byggforskuings institutt
   (Norwegian Building Research Institute)
   Fersknіugsin. 3G
   Blindern - Oslo 3

10.18 Poland

Although the Polish government is aware of the existing noise problems and norms and guidelines have been issued, it is indicated that despite all efforts directed in the preceding 10 to 15 years toward noise abatement in Polish industrial enterprises and residential and commercial areas, the overall number of worksites and dwellings with noise levels above the permissible limits has remained (as of 1973) still very large.

10.18.1 Laws, Regulations and Guidelines

The Decree of the Council of Ministers, August 12, 1971, under No. 169, recapitulates and summarizes the problem of health protection from noise and vibration exposure and the tasks of noise abatement. It also makes the existing supervisory authorities responsible for their individual industrial branches or related activities (transport , road traffic, etc.) The Decree makes the Polish Committee on Normalization and Measurement Units (Polski Komitet Normalizacji i Miar) responsible for the issuance of industrial norms, regulations and guidelines for the 1971-75 period.

The Decree specifically states that admissible noise and vibration criteria must be determined for each type of mechanical equipment. It is the responsibility of the manufacturer to take the existing limits into consideration; whenever certain machinery exceeds such limits, a fixed time should be set to either withdraw the product from the market or to rectify the causes of excessive noise or vibration. That criteria of admissible noise and vibration levels also applies to imported machinery. (10-103, p. 53)

10.18.1.1 Occupational

The problem of protecting the Polish worker from the effects of excessive noise and vibration levels seems to have priority over similar protective measures in non-industrial domains.

In countries of the Warsaw block there is a Permanent Committee on Building attached to the Council of Mutual Economic Assistance (RWPG) whose agenda also includes the problems of noise abatement and the issuance of normative guidelines for all industrial activities.

Like many other countries Poland also accepts recommendations on the threshold of noise exposure worked out within the ISO/TC-43 (ISO Draft Recommendation 235, 1961), although certain recommendations issued by the Warsaw Bloc Council deviate from ISO.

The Institute of Technical Acoustics (Zakład Alustyky Technicznej) of the Central Institute of Labor Protection (Centralny Instytut Ochrony Pracy, usually abbreviated to CIOP) singles out the following sources as being primarily responsible for excessive noise levels in engineering plants: pneumatic equipment (100 to 134 dB); power hammers (90 to 122 dB); smith hammers (100 to 120 dB); drills in mining operations (98 to 120 dB); power rammers in molding and casting operations (96 to 116 dB); presses in rolling mills, stamping plants and wire works (90 to 102 dB); circular saws (90 to 115 dB); fittings and fixtures in various valved equipment (100 to 120 dB); equipment for releasing or receiving pig iron (90 to 110 dB); various transport equipment in mines, especially cars and trolleys (95 to 108 dB); knock-out grids and molding equipment in foundries (90 to 106 dB); jets and nozzles in heating and open-hearth furnaces (90 to 108 dB); equipment in engine-test houses (200 to 125 dB); presses and hammers for plastic materials (92 to 120 dB); straightening, flattening and stretching equipment in aircraft factories, motor-vehicle plants and textiles and building machinery enterprises (102 to 116 dB); wood-working machinery (98 to 115 dB); equipment in fettling shops (about 115 dB) and rotary fettling tables (92 to 110 dB); jolting and vibrating machinery in engineering plants (91 to 111 dB); riveting and pneumatic grinding machinery (98 to 115 dB); braiding and other cable-working machinery (96 to 109 dB).

The following noise generating equipment is listed in the building industry and in enterprises manufacturing building materials: shaking screens (95 to 119 dB); crushers (96 to 113 dB); wood-cutting saws (97 to 115 dB); breakers and kneaders (98 to 105 db); frame saws (97 to 103 dB); polymerization chambers (112 dB); presses (92 to 110 dB); mortisers for woodworking (108 dB); ball mills, tube mills, plating barrels and shaking drums (93 to 110 dB); rotary kilns (91 to 99 dB); breaking machinery (104 dB); defiberizers (106 dB); concrete shakers (98 to 102 dB); planers and millers (97 to 101 dB); cabs of bulldozers and excavators (90 to 97 dB).

The following noise-generating machinery is mentioned as operating in light-industry enterprises: looms (102 to 112 dB); winders (94 to 114 dB); spinning frames (93 to 110 dB); drawing frames (97 to 104 dB); twisting frames (95 to 104 dB); cording machines (95 to 102 dB); warp frames (up to 101 dB); automatic stocking frames (up to 98 dB); other specialized machines (95 to 106 dB).

The following noise-generating processes and machines exist in enterprises of chemical industry: aerodynamic and hydrodynamic processes involving compression, decompression, and flow of fluid media; ventilators; processes involving breaking up and mixing of materials; processes involving transport of materials. Other noise-generating equipment in Polish industrial enterprises: machinery in power-generating plants, such as compressors, turboblowers and generators (97 to 115 dB); and, in metal-working and wood-working enterprises: automatic lathes, turret lathes, grinders, drillers and borers, power hammers, millers, sheet and plate mills, circular saws, band saws and planers and shapers (95 to 106 dB). (10-103, p. 5-9)

Legally binding norms and regulations on hearing damages and vibration-induced disorders in industrial workers are available in the following two official orders and guidelines. (10-104, p. 102-103)

1. Decree of the Council of Ministers from May 14, 1956, on detection and recording of occupational diseases (Dziennik Urzędowy, No. 27).
2. Guidelines of the Committee on Work and Wages from July 19, 1964, on vibration-induced illnesses (Dziennik Urzędowy, No. 2/16).

Legal provisions concerning the assessment of damages caused by noise and the existing measures on abatement of noise and reduction of vibrational hazards are available in the following orders (10-104, p. 102-103):

1. Decree of the Council of Ministers from August 21, 1959, on general health conditions including silencing measures in newly built or reconstructed industrial enterprises (Dziennik Urzędowy, No. 53).

2. Order by the Ministry of Communications, under No. 25/W (W standing for "internal affairs"), from December 15, 1959, on enactment and execution of regulations concerning work safety and hygiene in enterprises of communication engineering.

3. Decree of the Chairman of the Committee on Building, Urban Development and Architecture from July 21, 1961, on engineering and technological aspects of buildings and structural objects in general (Dziennik Urzędowy, No. 38). Noise control provisions include: (10-103), p. 52) sound-absorbing equipment must be installed in noise-infested industrial areas; special frames or foundations should be provided for noise and/or vibration-generating equipment such as ventilators, pumps, motors, engines, etc.; walls and ceilings of noise-infested rooms and halls should be insulated; offices should be screened from shop noise; and machinery should be designed to provide maximum safeguards against noise and vibration exposure. All new machinery, before being put in operation, should be examined for such characteristics.

In addition to the aforementioned orders and decrees, the following two existing regulations or legal codes are pertinent to the problem of noise abatement (10-104, p. 103):

1. Criminal Code and the Law on Offenses (articles 286, 230, 215, 242, 237, and 235 of the Criminal Code: articles 28 and 30 of the Law on Offenses).

2. Decree from November 10, 1954 (Dziennik Urzedowy, No. 52) on Trade Unions' responsibility to inspect working conditions and enforce regulations on work safety and worker protection.

Other existing orders, decrees, and guidelines (10-103, p. 49-50) are as follows.

The order of the Ministry of Health and Welfare (Ministerstwo Zdrowia i Opieki Społecznej) from April 16, 1968 (Dziennik Urzędowy No. 14) on keeping records of occupational diseases and procedures for their documentation and statistical evaluation. The portion on hearing damages defines such damage as difficulty for the handicapped person to understand human speech. This in turn is understood as a two-sided loss of hearing in the value of at least 30 dB, determined audiometrically and computed as an arithmetic average for frequencies of 1000, 2000, and 4000 Hz separately for each ear. Aging factor (presbycusis syndrome) should be accounted for: for persons 20 years of age - 1.3 dB, 30 years - 7.4 dB, 40 years - 12.7 dB, 50 years - 18 dB, 60 years - 27.4 dB, 70 years - 36.7 dB, 80 years - 44 dB.

Another Order of the Ministry of Health and Welfare, dated April 22, 1868, determines the necessary procedures for prophylactic examinations of workers. Still another Order of the same Ministry, dated August 2, 1968, states that such examinations for noise exposure above the prescribed limits should take place once in two years.

18.18.1.2 Emission limits-existing products

According to the existing Polish norms (PN-70/B-02151), (10-103, p. 84-85) permissible indoor noise levels in residential rooms, hospitals, schools and offices should correspond to recommendations of the Warsaw Bloc Council. (Table 10-21)

Type of Room	Permissible noise levels from all sources in dB(A)	
	for 8 most unfavorable hours between 6 and 22	for the most unfavorable half-an-hour between 22 and 6
Residential rooms (including hotels)	40	30
Hospital rooms	35	30
Doctor's offices	35	---
Operation Rooms	30	---
School rooms & labs	40	---
Conference rooms and auditoria	40	---
Rooms for intellectual work	35	---
Offices (without internal sources of noise)	40 to 45	

Table 10-21. Permissible Indoor Noise Levels in Residential Areas.

Source: (10-103)

The aforementioned Polish norm (PN-70/B-02151) sets permissible noise levels for the following worksites, tabulated in Table 10-22. The levels account for both external and internal noise sources.

Type of Room or Shop	Permissible noise level in dBA
Administrative offices with typewriters and calculating machines	45 to 55
Laboratories with internal sources of noise	45 to 60
Calculating offices, rooms for typists and teletypists	60 to 80
Manager's offices in industrial enterprises	65 to 75

Table 10-22. Permmssible Noise Levels in Worksites

Source: (10-103)

Tractors and farm machinery should not exceed the limits of 85 dBA. Telephone exchange halls and radio rooms should not exceed the limits of 60 dBA, whereas 65 dBA is set forth as the maximum permissible noise level for workrooms, recreational rooms, sickbays and offices aboard ships. All these norms correspond to recommendations issued for the Warsaw Bloc countries. It should be understood that on mainland (dry land) the corresponding limits are 30 and 35 dBA. In rooms aboard ships in which the level exceeds 90 dBA, e.g. in engine rooms, special ship handling and control rooms, areas must be made available whose levels should not exceed 70 dBA. (10-103, p. 89-90)

10.18.1.3 Emissions limits-new products

Noise levels in road transport vehicles (driver's seat) are set forth in the PN-71/S-04052 norms, applicable only to new factory products. Arithmetical average is taken, based on three measurements for each speed category. Noise levels should not exceed 60 dBA* for passenger vehicles, 82 dBA for motor trucks and 85 dBA for buses. Measurements should be made on asphalted roads with less than 1 percent slope and with wind velocities not exceeding 3 m/sec. (10-103, p. 89)

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* No data are given at what distance the measurements should be taken.

10.18.1.4 Zoning Approaches

Recommendation for various urban sectors, issued by ISO, differ from those issued to the Warsaw bloc countries (RWPG, PC 263-62). The latter are: for residential areas - N45 by day, N35 by night; for business sectors - N50 by day, N40 by night; for industrial sectors - N55 by day, N45 by night. Similar figures for Federal Republic of Germany read: 55 and 40 for residential areas; 55 and 40 for business sectors; and 65 and 50 for industrial areas (10-103, p. 93)

According to Warsaw Bloc recommendations (PC 263-67, August 1967), instead of applying admissible levels to individual urban sectors the following table of corrections should be used for computing levels for residential houses. (Table 10-23)

Locality of the house	Correction in dBA
In recreational sectors	-10
In residential areas	-5
In mixed residential-business areas	0
In downtown business sectors and industrial areas	+5

Table 10-23.

Polish Corrections to Noise Limits for Various Zones

Source: (10-103, p. 94)

10.18.2 State and Local Activities

Poland, being a centralized country with state-owned means of production, has no legislation that would apply to "local authorities".

10.18.3 Enforcement and Institutional Data

10.18.3.1. Enforcement

Although the Polish state norm states that noise levels to which workers are exposed for five consecutive hours should not exceed 90 dBA. (10-103, p. 8), the pertinent data assembled by the Central Institute of Labor Protection (CIOP) claims that in 1970 about 500,000 workers, or 13.7 percent of industrial labor force, were exposed to noise levels above the 90 dBA limit. These data are tabulated in Table 10-24.

	Percentage of workers exposed	
Branch of Industry	to noise	to vibrations
Heavy industry (metallurgical plants, shipyards)	19.1	26.75
Machine building	9.5	14.65
Light industry	34.8	9.55
Construction and industry of building materials	5.9	9.75
Chemical industry	5.7	7.8
Other Branches	25.0	31.5

Table 10-24.
Percentage of Polish Workers Exposed to Noise and Vibration

Reference(10-103, p. 11-12) also tabulated hearing damages and vibration illnesses by percentage to the total number of all occupational diseases. In 1971 the percentage of hearing damages to industrial workers was 25.5%, that is 1,280 persons were affected; it was second only to the overall number of cases of poisoning. Vibration illnesses occurred in 9% of all occupational disease, i.e. in 450 persons. This is due to the fact that the number of audiometric centers is still very low and that their services are generally inadequate. (10-103, p. 12)

Hearing damages per individual branches of industry are shown in Table 10-25.

Branches of Industry	Percentage of hearing damage (of the total number of occupational illnesses)
Heavy industry (metallurgy, shipbuilding)	45
Machine building	18
Light industry	11
Building and industry of building materials	7
Chemical industry	1
Other branches	18

Table 10-25.
Polish Occupational Hearing Damage by Industry
Source: (10-103, p. 12)

How far the noise-exposure levels have been adjusted in recent years is hard to say. A study was made assessing the noise exposure levels in various production shops in Poland from 1960-1971. (10-105, p. 4)

For illustration, these results are given (in an abridged form) in Tables 10-26a to 10-26e.

Type of shop	Total number of shops under observation	Noise levels in dB
Weaving plant	42	96-104
Spinning mill	32	89-102
Cording room	15	85-97
Roving frame room	6	92-102
Warping mill	6	78-90
Scutching room	6	95-101
Winding room	14	82-100

Table 10-26a. Noise Measurement on Worksites in Textile Plants.

Source: (10-105)

Type of room or worksite	Total number of worksites under observation	Noise levels in dB
Sorting and coal washing plants	24	89-107
Elevator (operator's cab)	4	91-94
Ventilator room	3	89-100
Compressor room	12	94-108
Underground pumping plant	4	93-100

Table 10-26b. Noise Measurement on Worksites in Mines.

Source: (10-105)

Type of worksite	Total number of worksites under observation	Noise levels in dB
Turbogenerator room	8	90-104
Turboblower room	10	95-103
Boiler operator's room	2	60-86
Boiler house	7	89-103
Coal pulverizing plant	6	91-109
Pumping plant	12	89-105

Table 10-26c. Noise Measurements on Worksites in Thermal Power Plants.

Source: (10-105)

Type of plant	Total number of plants under observation	Noise levels in dB
Worksite of blast furnaces	18	81-102
Steelmaking mill	19	85-96
Rolling mill	49	82-115
Agglomerating plant	12	93-109
Cokery	14	93-104

Table 10-26d. Noise Measurement on Worksites in Iron and Steel Works.

Source: (10-105)

Type of Plant	Total Number of Plants Under Observation	Noise Levels in dB
Hall with machine tools	64	81-104
Construction & assembly hall	78	79-109
Welding shop	17	86-103
Forge shop	26	83-106
Moulding & casting shop	15	80-111
Fettling & dressing shop	18	91-109
Woodworking shop & joinery	26	70-109
Boiler room	21	86-102
Compressor room	11	94-114

Table 10-26e. Noise Measurement on Worksite of Selected Engineering Plants.

Source: (10-105)

10.18.3.2. Institutional Data

List of Institutes in Poland Concerned with Noise Abatement

Name of Institute	Address	
Centralny Instytut Ochrony (Central Institute of Labor Protection), Dept. of Applied Acoustics	ul. Tamka 1, Warsaw	noise and vibration assessment; abatement through silencers, screens, earplugs; assessment of norms
Glowny Instytut Gornictwa, Dept. of Health Service (Central Mining Inst.)	pl. Gwarkow 1, Katowice	noise assessment and audiometric studies in mining; prophylactics and verification of measuring instrument
Instytut Cybernetyki Stosowanej (Inst. of Applied Cybernetics), Polish Academy of Sciences	ul. Krajowej Rady Narosowej 51-55 Warsaw	turbulent noise research, modelling methods
Instytut Badawczy Lesnictwa (Forestry Research Institute), Dept. of Labor Protection	Sekocin near Warsaw	saws and woodworking machinery noise; methods of measurement
Instytut Elektrotechniki (Electrical Engineering Institute), Sept. of Electric Machinery	ul. Janosika 28, Miedzylesie	electric motor noise assessment and measurement; silencing methods and devices
Instytut Lotnictwa (Aviation Institute)	ul. Krakowska 110-114, Okecie, Warsaw	noise suppressing in aircraft, esp. jet aircraft
Instytut Mechaniki Precyzyjnej (Precision Engineering Institute)	ul. Duchnicka 3, Warsaw	research in ultrasonics; designing of ultrasonic devices
Instytut Morski (Institute of Navigation), Dept. of Marine Technology and Operation	ul. Dlugi Targ	noise aboard ships, measurement and evaluation of norms
Instytut Obrobki Skrawaniem (Institute of Metalworking and Machining), Dept. of Machine Tools	ul. Obozna 14, Cracow	assessment and measurement of noise in machining halls; norms and noise abatement

List of Institutes in Poland Concerned with Noise Abatement

Instytut Organizacji i Mechanizacji Budownictwa (Institute of Management and Mechanization in Building Industry)	ul. Racjonalizacji 6-8, Warsaw	measurement and assessment of construction machinery noise
Instytut Podstawowych Problemow Techniki (Institute of Key Problems in Technology), Polish Academy of Sciences, Dept. of Cybernetics and Acoustics	ul. Swietokrzyska 21, Warsaw	research in and designing of measuring instruments, filters and electro-acoustic devices; norms and guidelines
Instytut Techniki Budownlanej (Institute of Building Technology)	ul. Ksawerow 21, Warsaw	acoustic in buildings and swellings; assessment of localities for buildings; insulation and screening; working out norms
Instytut Techniki Cieplnej (Institute of Heating Engineering), Research Laboratory of Ventilator Noise and Vibrations	ul. Mysia 2, Warsaw	working out norms of permissible noise levels in power plants
Instytut Medycyny Pracy w Przemysle Weglowym i Hutniczym (Institute of Occupational Medicine in Mining and Metallurgical Industries), Dept. of Physical Injuries and Traumas	ul. K. Marksa 17, Zabrze Rokitnica	noise, vibrations and ultrasonic effect on human health and measures of protection
Instytut Medycyny Pracy w Przemysle Wlokienniczym i Chemicznym (Institute of Occupational Medicine in Textile and Chemical Industries)	ul. Teresy 8, Lodz	noise hazards and audiometry
Instytut Odlewnictwa (Institute of Metal Founding)	ul. Zakopianska 73, Podgorze, Cracow	noise problems in foundries

List of Institutes in Poland Concerned with Noise Abatement

Przemyslowy Instytut Maszyn Rolniczych (Industrial Institute of Farm Machinery)	ul. Starolecka 31, Poznan	noise control in farm machinery, esp. sprayers and rams; methods of measurement and norms
Centralny Osrodek Badawczo -Projektowy Gornictwa Odkrywkowego "Poltegor" (Research and Designing Center for Strip Mining)	ul. Nauczelska 4, Wroclaw	acoustic insulation of equipment, esp. of the "Trelebork" type
Centralny Osrodek Badan i Rozwoju Techniki Kolejnictwa (Research and Development Center for Railway Technology)	ul. Chlopickiego 50, Warsaw	acoustic properties of the rolling stock and norms
Centrum Techniki Okretowej, Pracownia Drgan i Akustyki (Marine Technology Center, Laboratory of Acoustics and Vibrations)	ul. Waly Piastowskie 1, Gdansk	noise abatement and measurements abroad ships
Hutniczy Osrodek BHP (Mining Engineering Center, Industrial Safety and Hygiene)	ul. Truchana 8, Katowice	human engineering studies including protection from noise
Centralny Osrodek Konstrukcyjno-Bodawczy Przemyslu Motoryzacyjnego "Polmo" (Research and Designing Center of Motor Vehicle Industry), Dept. of Acoustic Research in Motor Transport	ul. Stalingradzka 23, Warsaw	noise and vibration control in motor transport
Osrodek Badawczo-Konstrukcyjny (Research and Designing Center), "Hydropneuma" Laboratory	Archimedes Engineering Works, Wroclaw	noise and vibration in pneumatic machinery
Centralne Biuro Konstrukcji Lozysk Tocznych (Central Bureau for Designing and Building Anti-friction Bearings)	ul. Rydygiera 11-13, Warsaw	rolling bearing vibrations problems

10.19 Soviet Union

Although there have been recent legal revisions, the USSR has had law controlling noise on the books since 1956. Most of Soviet law concerning noise is in the form of administrative law promulgated by the various ministries. There is no comprehensive agency for noise control and abatement in the USSR, but the Ministry of Health plays a leading role. The strongest area of coverage is industrial protection of the workers' hearing. Yet existing laws also cover most of the other areas -- transportation noise sources, residential and city noise -- and most of the commonly-known legal approaches: zoning, measurement and labeling of noise-producing machinery, building codes, disturbance-of-the-peace statutes.

10.19.1 Laws, Regulations and Guidelines

10.19.1.1 Occupational

In December 1975 a new regulation was issued requiring emissions noise limits on various types and models of new industrial equipment. What little is known about these limits is discussed in a following section (10.19.1.3) on emissions limits for new products.

Occupational noise limits have been tightened over four times in the last twenty years in the USSR. Regulations issued by the two different agencies on the same topics are now in effect. Table 10-27 identifies various regulations:

No.		
SN-1004-73	1973	All permanent factory workplaces. Issued by Health Ministry.
SN-245-71	1971 (in effect from Apr. 1, 1972)	All new or reconstructed workplaces, including agriculture and transportation as well as factories. Issued by State Construction Commission ("Gosstroy").
SN-877-71	1971	Railroad workers, replaces SN 276-58.
SN 872-70	1970	New workplaces. Issued by State Construction Commission. Confirmed Dec. 1970.
SN 785-69	1967	Superceded by SN 245-71.
SN 276-58 (temporary)	1958	Railroad workers.
ON 20-62	1962	Railroad workers. A more severe norm promulgated by the Ministry of Railroad Transport to augment SN 276-58. The only known case of a Ministry of exersizing its right to develop stricter norms for itself than those assigned by the Ministry of Health.
SN 416-62	1962	Sailors or maritime, river and lake vessels.
MAP 6123-50	1950	Flight crews on passenger aircraft (civil aviation).
GOST 11870	1966 (effective 1968)	Standardization of measuring and labeling noise emission of machinery.
REG 136	1957	Determination of noise-induced deafness nervous disorders as occupational diseases.

Table 10-27. Work-Related Soviet Norms on Noise.

The 1973 Sanitary Norm for industrial noise 1004-73 incorporates the concept of allowable noise spectral curves recommended by the TC-43 "Acoustics" Committee of the International Standards Organization (I.S.Q.). For example, the most permissive norm for the worker in the factory corresponds to I.S.O. curve "Index No. 75" and sets the limits shown in Table 10-28.

Center frequency of octave bands (hertz)	63	125	250	500	1000	2000	4000	8000
Maximum noise level permissible in that octave band (dB)	94	87	81	77	75	73	71	69

(The Index Number is derived from the maximum noise level allowable for the octave band centered around 1000 hertz.)

Table 10-28. I.S.O. Curve NR 75

Source: (10-107, p. 29-35)

If the noise does not have an unusual frequency composition, this "75" curve roughly corresponds to a maximum of 80 dBA. It can be seen on Figure 10-3 . This graph and the accompanying key also indicate allowable maximum Soviet noise levels for workers in various other occupational settings.

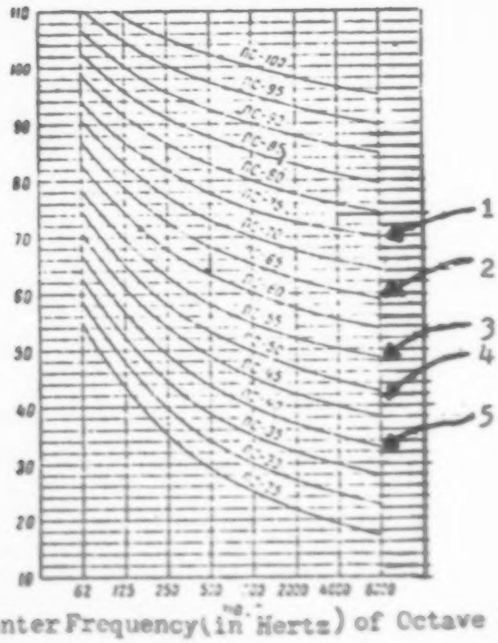

Figure 10-3. Basic Provisions of Soviet Regulation 1004-73 Concerning Maximum Levels of Noise in Occupational Settings.

Source: (10-107, p. 29-35)

KEY:	Index No.	Approx. Equiv. in dBA
1. Ordinary workplaces in factories, etc.	75	80
2. Laboratories with noise sources.	65	70
3. Remote control and observation stations in factory automated processes.	55	60
4. Offices with office machinery.	50	55
5. Offices where thinking work demanding high levels of concentration occurs.	40	45

Because in other occupational settings there is more technical possibility for noise control and amount of concentration demanded by the job, the noise standards are stricter. To be permissible under these norms, the noise in an occupational setting must be equal to or less than that prescribed by the corresponding index number at every frequency.

If the noise being checked has significant impulse noise characteristics, or if it has in it "the special existence of pure tones",* the applicable norm is made 5 dB stricter at all frequencies. (10-108)

Following I.S.O. recommendations, the basic Soviet norms described above may be adjusted if the duration of the noise is less than an entire eight-hour shift, according to the Table 10-29.

Table 10-29 Adjustments to Regulation 1004-73 in Respect to Noise Exposures Less Than an Eight Hour Shift

If the duration of the noise is	Adjustment to be added to the ISO curve (= the approximate amount in dBA by which the norm is made more lenient)
45 min--1½ hours	5
30 min--45 min.	10
15 min--30 min.	15
less than 15 min.	20

---

* Legally defined as present if there is in the spectrum at least one 1/3 octave band in which noise is 10 dB or more greater than in the adjacent bands. (10-120)

Example: A laboratory with noise sources is generally quiet but has a piece of equipment producing a noise level throughout the lab of up to 93 dBA for less than 15 minutes a day.

Appropriate ISO curve No. 65 + 20 = ISO curve No. 85 = 90 dBA applicable to this lab situation.

The noise environment of the lab is probably not within permissible Soviet limits.

If noise cannot be reduced to meet the limits, it is permissible (and compulsory) to use ear protectors.

Periodic health examinations are compulsory for workers in workplaces of more than 95 dBA. The local Trade Union representative is charged--for pension control purposes--equally with the physicians in verifying that possible hearing disabilities were in fact work-related. (10-109)

Other Occupational Regulations

The Railroad Ministry had tighter than average norms in the past and has modified but not further tightened them in the last four years. (Table 10-30)

Type of noise situation	Permissible sound pressure levels (dBA equiv.)	
1. Engineer's cabin of locomotives, cars carrying power plant of diesel locomotive, personnel-carrying sections of refrigerator trains.	80	(measured on loaded locomotive moving at 2/3 normal max. power)
2. Examples: in cars of locals and commuter trains, in the crew-rest sections of construction (work) trains.	75	
3. Passenger cars, medium distance trains.	70	
4. Exposure more than 24 hours: Examples: passenger cars of long-distance trains, crew-rest sections of baggages and postal cars, railroad office cars.	65	(measured at speeds 2/3 of nominal "constructed" speed ± 10 km/hour.

Table 10-30. Noise Control on Trains per Sanitary Norms 877-71.

Source: (10-107, p. 36)

The noise norms protecting Soviet sailors on board ships employ the same frequency/level/duration criteria employed in the norms already discussed. The difference is that the sailors' "home" environment--i.e., the cabin where he lives when off-duty--may need noise protection standards just as much as his duty station does. As shown in Table 10-31 the maritime norms take this into account.

Noise situation	ISO No.	Approx. equivalent in dB(A
Sailors on duty (measured at duty station)		
Exposure to maximum level is less than two hours per day.	90	95
Exposure to maximum level is two-seven hours per day.	80	85
Exposure for entire watch at isolated (remote control) duty station.	65	70
Sailors off duty (measured in his cabin, common rooms, rest area)		
Exposure is greater than 24 hours at a time.	40	45
--8 to 24 hours	45	50
--less than 8 hours	50	55
--less than 8 hours, & no facilities for sleeping on board (river hydrofoils)	55	60

Table 10-31. SN 416-62
Maximum Allowable Noise Levels on Board Soviet Ships.

Source: (10-110)

10.19.1.2 Emissions Limits-existing products

This tactic so far has not been incorporated into the Soviet regulatory approach.

10.19.1.3 Emissions Limits -new products

In 1971, we reported that GOSSTROY had ordered the step-by-step development and incorporation of measurement standards for all machinery types of all branches of industry*.

Evidently the GOSSTROY is now in the process of prescribing meissions limits for some makes and models of machinery for which measurement standards have been developed.

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* A related regulation GOST 11870-66, confirmed in 1966 and being introduced gradually, is aimed at helping Soviet branch industries meet norms on noise through correct design and layout of industrial plants. GOST 11870-66, "Machines: noise characteristics and their measurement," makes it compulsory for noise emission characteristics of all new Soviet machines to be measured in a standard fashion while they are in the prototype and testing stage, and to be labeled with noise documentation when they are produced and sent to the plant where they will be used. It applies to all machinery including vehicles (while they are stationary) and mechanized instruments, and also to some machine components such as gears, but does not cover machinery producing impulse noise.

10.19.1.4 Zoning Approaches

The USSR has attached great importance to noise zoning for over fifteen years.

Residential and noise sensitive areas

In the USSR a relatively high percentage of the population lives in housing particularly vulnerable to noise: un-airconditioned, multi-family apartment buildings, often constructed from prefabricated concrete panels, and arranged in complexes around common courtyards.

No.	Date	Field of Application
SN 535-65	1965	Supercedes SN 337-60.
SN 337-60	1960	Noise levels inside apartment houses and noise-sensitive buildings.
SN 41-58	1958	Location of housing (e.g., with respect to city transport) to reduce noise immission into housing areas.

Table 10-32 Soviet Norms on Noise in Residences.

The effect of industrial noise emissions to residential and public buildings in adjacent neighborhoods is also covered by the industrial noise law. In a 1956 sanitary norm a "design recommendation" was 50 phon (approximately 60 dB in usual circumstances) at the boundary of the industrial property (SN 205-56, B. 14,c. (10-109) In 1963 the form of the regulation was changed to a norm with the specification of a measurement two meters away from the residential or public buildings to be protected. The limits--again expressed in terms of spectral curve index numbers--are those shown in Table 10-33.

Location of industry	ISO Index No.	Approximate Equiv. in dB(A)
For industries in populated areas:		
"Day" (8:00 am to 11:00 pm)	50	55
"Night" (11:00 pm to 8:00 am)	40	45
For industries with "sanitary-protective" zones (sanitarno-zashchitnyee zony)*:		
"Day"	55	60
"Night"	45	50

*Zones around all Soviet factories with an emissions problem (air, water, noise); noise-sensitive institutions are not supposed to be located inside a sanitary-protective zone.

Table 10-33 Maximum Industrial Noise Emissions to Neighboring Areas.

Source: (10-111)

For norms protecting housing by limiting industial noise coming from adjacent areas, the determining measurement is made at the outside of nearby non-industrial buildings, two meters away from the direction of noise. The railroads are also evidently considered responsible for taking into account the noise transmitted to both sides of rights-of-way, at least where new rights-of-way are concerned. (10-112) The so-called sanitary protective zones (sanitarnaya zaschitnaya zona) around Soviet industries are another Soviet statutory institution that controls the transmission of industrial noise to the environment. The original scheme was promulgated by Soviet public-health authorities to isolate the public health problems (smoke, gases, danger of explosions) of "dirty" industries. The extent of the sanitary-protective zone depends on the type and size of the industrial plant, and is legally specified in detailed regulations by class and category of industry Noise has always been one consideration in the determination of sanitary-protective zones, but recently more emphasis has been put on the noise aspect, and the concept is being adapted for use around airports,

As can be seen from Table

industry for its noise emission to buildings erected inside a sanitary-protective zone is about 5 dBA less severe than for other buildings.

The effect of traffic noise on housing and other buildings, is controlled by SN 41-58, "Rules and norms of city planning and construction" (issued by GOSSTROY, 1958) and subsequent modifications. No. 41-58 specifies methods of planning of streets, apartment locations, vegetation plantings, and noise abatement on city transport systems to reduce noise problems.

Control of design and construction: Noise level norms

These norms take over at the boundary of the housing region, using the existing external noise environment as a "given" and specifying noise abatement methods to be used in situ. Maximum permissible noise levels are specified by SN 337-60, as superceeded by the more comprehensive SN 535-65, and the building insulation and construction design specifications needed to meet them are specified by SN 39-58 (with I 104-53) and later modifications thereof.

SN 337-60 specified the maximum noise levels of noise immission into residential areas of apartment buildings. (In the ISSR many apartment buildings have retail stores and service industries built into the ground floor.) These maximum levels were specified by measurements inside the rooms as follows:

Daytime (8 a.m. to 10 p.m.)	ISO octave band curve index No. 30
Night-time (10 p.m. to 8 a.m.)	ISO octave band curve index No. 25

These levels are approximately equal to 35 dBA for daytime and 30 dBA at night, and preliminary noise checks by Soviet authorities may be made with a noise meter registering in dBA. However, the standard was relaxed by 5 dB for buildings whose windows faced the principle street of a neighborhood, and by 10 dB if they faced a main city traffic artery. Thus for example, maximum noise allowed in a living-room facing a main city artery would be 45 dBA during the day and 40 dBA at night. It can be seen how this relaxation "dovetails" with the SN 41-58 norms, meeting potential objections of the city planner that limits inside housing should be practicable. Under SN 337-60, measurements were to be taken in furnished rooms with the windows and doors closed. If the room was unfurnished then the maximum readings were allowed to be 3 dB higher across the board to compensate for reverberation effects. If impulse noise or pure tones of noise were present, they were taken into account by making standards 5 dB stricter, across the board.

SN 535-65 superceeds SN 337-60; it incorporates the features of 337-60 but is much more comprehensive. It may be considered the definitive Soviet norm on noise in housing. It specifies limits both inside buildings and outside buildings, in the communal land of the apartment complex. Moreover, the factors included in determining the maximum permissible noise level for a particular housing unit include not only the time of day and whether there are nearby major roads, but also the time of year, duration of the noise, and whether the setting is urban or suburban. Table 10-34 gives the basic norms. To the basic norms are added or subtracted the adjustments. (Table 10-35)

Table 10-34. Basic Norms of SN 535-65 (before adjustment).

Location	ISO curve no.	dB(A) equivalent as given by Soviets
Inside the rooms of apartments:	25	30
Outside apartment buildings (courtyards, recreation spaces):	35	40

The maximum permissible noise levels for a particular housing situation may be calculated from the tables. It is interesting that less severe norms are in effect for housing sited near freeways (main city artery or inter-city highway) and in sanitary-protective zones. Referring to Table 10-35), for example, we see that a housing area in a city near a busy neighborhood road gets extra protection, (-5 dB) but if it is near a freeway it is "written off"; the maximum noise level is raised, evidently in deference to the technical difficulty of coping with heavy, continuous traffic noise (+10 dB).

10.19.1.5 Other Activities

Control of design and construction: practice SN 39-58 (with I 104-53 and modified by SNiP II. V.6.62) covers noise abatement practices to be observed "by all design and building organizations" for the sound insulation of "apartment houses, dormitories, hotels, schools, children's institutions, hospitals, and public administration buildings." No limits in terms of dB numbers are specified. Among

Table 10-35

SN 535-65: Table of Adjustments for Determining the Norms for a Particular Residential Situation.

Situational factor	Correction to octave-band curves: Amount by which the index No. is to be shifted, more restrictive (-) or less restrictive (+)
Quality of noise:	
pure tones present	-5
impulse noise present	-5
Total time of noise duration in daytime (7 am to 11 pm), in each and every 8-hour period:	
50-100% of time	0
12-50%	+5
3-12 %	+10
0.8-3%	+15
0.2-0.8%	+20
less than 0.2%	+25
Time of day:	
daytime (7 am to 11 pm)	+10
night-time (11 pm to 7 am)	0
Time of year:	
winter (windows closed)	+5
summer (windows open)	0
Proximity of major city transport lines:	
absent	0
principle neighborhood road	-5
main city artery or inter-city highway	+10
Location of housing area:	
in the suburbs	-5
city development	0
within a sanitary-protective zone	+10

Adjustments to be added to basic SN 535-65 norms given in Table (10-34)

Source: (10-112)

other points covered are the following:

1. Structures containing intense noise sources must be sited at a distance from buildings in which quiet is needed.

2. Kitchens and sanitary facilities in dormitories and hotels, and sanitary facilities in apartments should be located in a separate construction cell insulated with wooden material, or they should be separated from living rooms and bedrooms by a hall, corridor, etc. These construction cells should be sited vertically one above the other on the various floors. If it is necessary to locate a sanitary facility adjacent to a living room, installation of the facility on the common partition is not permitted.

3. Kitchens and sanitary facilities are not to be located adjacent to classrooms or hospital wards.

4. Dining rooms not to be adjacent or over classrooms, living quarters, or hospital wards.

5. Boiler rooms, elevators, pumps are not to be located directly under or adjacent to living quarters, childrens' rooms, or classrooms.

6. Trash shafts are not to be adjacent to living quarters.

7. Water and sewage pipes should not be set in the walls adjacent to living quarters.

8. Prohibited is the direct fastening to the construction elements of the building of electric motors, pumps, transformers, and other equipment producing noise. Instead they must be mounted in or on separate structures isolated from the rest of the building structure.

9. Also included are construction guidelines for making party walls and doors more soundproof for the same weight of materials.

More specific construction guidelines are given in SNiP II. V.6.62. In particular, they specify minimum allowable attenuation of airborne sound through a partition, and minimum of attenuation of impact sound and airborne sound through floors and ceilings. These limits are not to be measured by in situ measurements however, but rather by specification of certain wall and floor constructions deemed to satisfy the requirements.

10.19.2 State and Local Measures

The USSR is a centralized state and there is little action on the provincial level, although provincial organs are required to oversee the implementation of state norms.

On the city level, the attitude of the local authorities has great significance for the success of local noise control. Only if the city council mounts a noise control campaign and systematically monitors compliance will all of the numerous requirements issued by the central government be obeyed. For example, in Riga, a city noise control Commission required all factory and builder managers to submit noise control plans. The Commission included the deputy city council heads, the chief sanitary doctor of the city, and the chief town planner. A noise map of the city has been used to prevent new housing from being built in an area where the noise exceeds 70 dBA. Most of the city center is now a low noise zone, thanks in part to a greenbelt area extending through it. It is planned to make the "Old Riga" section of town a zone for pedestrians only. In the years 1972-74, several streets have been converted to one-way street. Much truck traffic in the city center, especially at night-time was traced to drivers stopping to eat at home before their runs. Over 1000 tickets were issued, and the driver's organization was fined as well as the driver. Confiscated were 369 mufflerless motorcycles, as well. New housing is now inspected for noise from heating systems or elevators before the city accepts it from the construction enterprise that built it. None are accepted or occupied until they are sufficiently quiet. (10-114)

One national nuisance ordinance exists, the Regulations governing the behavior of residents. The law of July 26, 1966 makes the creation of a public nuisance or behavior in a public place 'insulting' to the social order a minor criminal offense; noise nuisance is included under this law. The maximum penalties are: a fine of 10-30 rubles or 10-15 days confinement or one to two months corrective labor (e.g. street cleaning) with confiscation of 20% of pay. Many city governing councils have passed similar local statutes adapted to their special circumstances

10.19.3 Enforcement and Institutional Data

10.19.3.1 Enforcement

Enforcing any norm in a centralized system as vast as that in the Soviet Union is difficult and slippage is likely to occur somewhere between the top and the bottom. However, much practical work is being done in the factories and cities, as evidenced by a steady stream of articles in the literature. There is probably short-run noncompliance in existing plants with frequent compliance in design of new plants.

Enforcement Institutions

The various sanitary norms and other norms previously enumerated were developed chiefly in the Soviet Ministry of Health and confirmed, or "enacted", by the Chief Sanitary Physician of the USSR, the head of the VTsSPS (All-Union Central Council of Trade Unionts), and GOSSTROY (State Committee on Construction Affairs), acting either jointly or alone. Thus, the norms have the form of administrative law. Underlying them, however, is the recent version of the "Bases of law of the USSR and union-republics concerning health," confirmed in 1969 by the Supreme Soviet. This basic code of the USSR on health specifically covers noise pollution. It assigns primary statutory responsibility for implementation and enforcement to the Sanitary-Epidemiological Service (SES) and its regional and municipal stations throughout the USSR. It also obliges all factory managers, administrators, and officials, (especially members of the city councils) to cooperate fully with the SES. For factory managers, this means responsibility for on-the-job medical and health care, and the provision of office and logistical support to representatives of the SES. (10-108)Under the Osnovy, violations of sanitary norms are punishable by "disciplinary action, administrative action, or punishment under the criminal code." Furthermore, the Osnovy makes all citizens responsible for cooperating with the SES by observing sanitary norms and reporting infractions in "factories, residences, public buildings, apartment complex courtyards, streets, and city squares. (10-109)

The sanitary norms promulgated by the Ministry of Health are minimum standards: they do not preclude a Soviet ministry from making stricter noise limits for its branch of industry.

However, the Ministry of Railroad Transport is the only example we have found of a Soviet ministry that has done so. Its (then) stricter norm (ON 20-62) has been previously mentioned.

A legal instrument of even less force than the sanitary norms are the Declarations (postanovleniye) of the Council of Ministers of the Supreme Soviet or the Central Committee of the Communist party, which indicate basic policy concerns of the Government in a general way without including specific regulations. Ministries are formally obliged to take the Declarations into account. Recent Declarations concerning noise include:

> Incorporation of a noise "plank" in the Party Congress, Report of 1975.
>
> (Central Committee of Communist Party) "Concerning measures for the further improvement of health and the development of medicine," 1968.
>
> (Council of Ministers) "Concerning measures for limiting noise in industry," 1960.

The 1960 measure obligated ministries and institutions to improve equipment whose noise exceeded the sanitary norms, and to develop noise control measures. It also obligated scientific research institutes (NNI's) to develop new quieter machines to replace those present types whose noise could not be lowered (for example, presses, textile equipment).

Besides the official enforcement mechanism, there is a somewhat unique practice in the USSR of encouraging publication in the local press of voilations of regulations that were being allowed to continue. Much data on Soviet enforcement at the local level comes through such press items. It frequently reflects the efforts of local health authorities to get leverage on State industries who report directly to Moscow and thus have a degree of immunity from local control.

10.19.3.2 Institutional Data

The Erisman Institute's primary interest is environmental matters of all types. It has been active in noise-related problems since at least the early 1960's. It published a book on industrial noise hazards in 2964, and in the same year one of its leading members, I. L. Karagodina published a book on noise in cities and housing. (10-115) A series of studies by the Institute led to a revision of the Sanitary Norms No. 337 of 1960 setting the standards for noise levels in housing; the new Norms (SN 535-65) were much more comprehensive in coverage and adaptable to specific housing situations. The Institute is currently working on abatement techniques for urban environments, particulary zoning-type measures.

However, there is no single research organization in the USSR where noise-control research is centered. Other important Soviet organizations in this field include the following:

Ministry of Health

All of the local Sanitary-epidemiological Stations (SES) of the SES system under the Ministry of Health perform research and report their findings regularly in publications of the Ministry.

The Institute of Labor Hygiene and Occupational Diseases of the Academy of Medical Sciences in Moscow

(Institut gigieny truda i professional'nvve zabolovaniya.) The Institute has a laboratory of noise and vibration (I. K. Razumov, director) that worked out the 1969 Sanitary Norms for noise standards in all types of workplaces.(10-116) These are the most important noise norms currently in force in the Soviet Union.

The Leningrad Institute of Safety Engineering

(Lengradskiy Institut Okhrana Truda--"LIOT".) The head of the Institute, D. M. Matalionik, is not directly involved with noise but has represented the institute at international noise conferences. The head of the noise control laboratory is Ya. Il'yashuk, who has also written a book in industrial noise norms. In the USSR a weighting method for converting a set of one-third octave band readings in dB into a single-number reading is called the Il'yashuk method. Il'yashuk has been something of a spokesman to foreign visitors on Soviet noise control; a lengthy interview, in which he stated that over 12,000 engineers in the Soviet Union were working on noise abatement and control, appeared in the English press in 1971. LIOT does work in development of measuring equipment for industrial and field use, and on the effect of noise on the human organism. (10-117)

The Leningrad Sanitary Hygiene Medical Institute

(Leningradskiy Sanitarno-Gigienicheskiy Meditsinskiy Institut--LSGMI.) The most prominent member of LSGMI is Ye. Ts. Andreyeva-Galanina, who has headed many projects on the effects of noise on the human organism and participated in the drafting of sanitary norms.

The Scientific Research Institute of Construction Physics (NNI stroitel'noy fiziki), Moscow.

A leading member of this building research-type institute is G. Osipov, whose work has included traffic noise and hospital soundproofing. (10-118) E. A. Leskov has worked on air conditioning noise.

The V. V. Kuibyshev Engineering-Construction Institute in Moscow

(Moscovskiy inzherno-stroitel'nyy institut im. V. V. Kuybysheva.) Like the Moscow Construction Physics Institute, a more practice-oriented institution, it has done noise abatment work and studies showing the economic benefits (productivity increases) of noise (S. D. Kovrigin and A. P. Mikheyev). This team of Kovrigin and Mikheyev also participated in developing a complete noise-abatement program for Soviet post offices. (10-119)

10.20 Latin American Countries*

Noise produced from motor vehicles is the main noise pollutant in Latin American countries. (10-123)

10.20.1 National Laws, Regulations and Guidelines

Legislation on noise control has been limited to municipal and local ordinances issued in some cities.

10.20.1.1 Occupational

10.20.1.2 Emission Limits - existing products

Existing products regulations to control noise produced from existing products or sources is non-existent to the best knowledge of this survey. The following information may give a general overview of the density of noise and its sources in those countries.

The traffic noise sources are not too different from the rest of the world. Surface traffic is formed mostly by cars, predominantly small and compact like those popular in Europe; although a higher amount of older models stay in circulation. Buses and trucks, mostly diesel-engined (Leyland, Mercedes, G.M. and Mack are common) also include many older models. Muffling is poorly maintained or absent. Motorcycles usually have small engines (one cylinder, 125 cc or less) and are still more defective in muffling, exhibiting a world-wide preference of owners for the noisier types.

Cordoba, Argentina, is perhaps a typical quiet city. Its 800,000 inhabitants own 110,000 vehicles according to its Mass Transit Research Agency. Growth is of the order of 8% per year. The daily flow is of the order of 250,000. Downtown traffic is very crowded, with frequent jams at peak hours. In 1960 licenced motorcycles and scooters reached a maximum of 55,000 but are rapidly decreasing as second-hand cars become accessible to workers. Trains have modern diesel locomotives but the rolling stock is old and so are the tracks. Luckily, trains are not frequent and affect limited residential or downtown areas. So street traffic predominates. Subways exist only in a few of the capital cities. Mexico City's Metro is particularly silent as it rides on rubber wheels.

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* This report about Latin America has been largely based on an article entitled "Subjective Evaluation of Transport Noise in Latin America" by G. L. Fuchs published in the Journal of Sound and Vibration (1975) (Ref. 1).

Air traffic is not so dense as in Europe or the United States and the aircraft are mostly jets of medium size. Airports are not close to downtown, with a few exceptions. But land subdivisions are allowed unrestricted and the NEF 40 contours are trespassed, so that in twenty years from now we may expect an acute crisis from airport noises.

10.20.1.3 Emission Limits -new products

Regulations to control noise limits of new products are non-existent.

10.20.1.4 Zoning Approaches - See the Cordoba, Argentina regulation Sec. 10.29.2.

10.20.1.5 Other National Measures in the Legal Framework

1. Environmental Effects on Noise

Latin American cities were built on the Spanish Colonial tradition, with very little town-planning improvements. Their narrow streets and few avenues are flanked by higher construction. Green and wooded areas are quite scarce, except in recent residential developments. Factories originally built in the outskirts are now surrounded by dense housing. Parking spaces are in short supply as automotive production increases so fast. Public transport cannot catch up with the growth rate and this puts pressure on people to live as close as economically feasible to downtown. Lack of synchronized lights in most avenues, and buses driving through most streets, create constant jams. Impatient sounding of horns and unnecessary acceleration add to the exhaust noise. One capital city should be singled out in Latin America for banishing honking entirely: Santiago, Chile. In contrast, other cities like Lima, Peru, endure a constant tooting din to which impatient drivers concur by pounding on their doors!

The mild weather predominant in most Latin American cities (except perhaps southern Chile and Argentina) invites living with open windows. This reduces the normal expected attenuation of about 20 dB to 10 dB or less. The low interior absorption of tiled floors, plastered brick walls and concrete roofs aggravates the subjective effects by adding reverberation. Residential districts have low traffic density but are pestered by motorcycles and hot-rodders, especially on weekends. Vans fitted with horn loudspeakers are commonly used for commercial and political advertising at full volume. To sum up: the environment is a negative factor with a strong tendency to get worse in time. Since some 25% of the Latin American population lives in, at most, half a dozen cities in each country, our main concern is control of urban traffic noise.

2. Noise Surveys

A systematic study of traffic noise levels and public reaction to it is under way in Buenos Aires city, sponsored by the municipal authority and conducted by Professor Malvarez, of the National University of Buenos Aires. Several noise measurements have been carried out, mostly in Brazil, Uruguay, Argentina and Chile. The earliest attempt known of was in charge of Professor Paulo Sa, who drew an acoustical chart of Rio de Janeiro, where zones of 50-90 dB were contoured in shades changing every 10 dB. Palhano Pedrozo reported a subjective survey on main causes of annoyance in 300 homes in Rio. Excessive traffic noise ranked third, with 10% of the answers. Copacabana, the most densly populated area of Rio, gave 20% to noise, and moved it first in the ranking. Sources of annoyance inside homes turned out the following statistics: 22% unmuffled cars and motorcycles; 20% automobile horns; 16% streetcars; 13% buses and trucks. In Montevideo, Uruguay, Professor Carbonell surveyed various city noises objectively, reporting levels in dB(Lin) and octave-band analysis. It is interesting to note that distances to source were taken, an important parameter generally overlooked in those times. Vehicles measured at 3 to 8 meters reached levels of 56-106 dB.

In Cordoba, Argentina, the author, Prof. G. L. Fuchs, measured levels of most of the cars in circulation with the ISO stationary test, reporting levels in dBB which was the Swiss recommendation of 1959. Histograms showed 80 dBB as the most frequent level from sampled measurements downtown. On that occasion a one-week noise abatement campaign was successfully launched, and a "noise thermometer" mounted on a mobile laboratory. Prof. Fuchs is currently planning an objective survey of Cordoba for the Mass Transit Authority and hope to correlate noise-pollution levels with effects of noise on sleep, relaxation, mental work and communication.

10.20.2 Provincial and Local Legal Framework

The first Latin American city to have noise legislation was San Paulo, Brazil. Its municipal ordinance No. 4805 reported to the 3rd ICA established a limit of 85 dBB for vehicles in general. In 1965, the Cordoba, Argentina, municipal authority passed a law (Ord. No. 4977) with limits in dBB as recommended by the Swiss.

In 1967 the weighting was changed to dBA, following British and Austrian research. It is worthy of mention that Ord. 4977 pioneered in classifying noises in two categories: unnecessary (punishable without decibel limits), and excessive, with decibel limits for traffic and community noises. Swiss recommendations were adopted. Variability was taken into account by limiting "frequent" and "scarce" peaks Since then many Latin American cities have passed similar regulations. The most recent example is the city of Monterrey in Mexico.

(at a distance of 7.5 meters on the side of the exhaust pipe)

Vehicle	Level dB(A)	Proposal (1975)
1. Light motorcycle up to 50 cc	75	80
2. Motorcycle 50-125 cc	82	
3. Motorcycle over 150 cc (2-stroke)	84	
4. Motorcycle over 150 cc (4-stroke)	86	
5. Motorcar up to 3·5 ton	85	80
6. Motorcar, truck, bus, over 3·5 ton	89	85

Table 10-36 City Council Act (municipal law) for Cordoba, Argentina: maximum vehicle sound levels.

Source: (10-123)

	Ambient noise		Frequent peaks		Scarce peaks		
Environment	Night	Day	Night	Day	Night	Day	Observations
I	35	45	45	50	55	55	Hospitals, sanatoriums, asylums, clinics
II	45	55	55	55	65	70	Residential, schools, small shops
III	50	60	60	70	65	75	Downtown apartments and stores
IV	55	65	60	75	70	80	Industrial areas

Table 10-37 Community Noise Limits Inside Buildings for Cordoba City, Argentina. (Ord. 4977) All Sound Levels in dB(A) and measured inside one meter away from open windows.

Source: (10-123)

10.20.3 Enforcement and Institutional Data

10.20.3.1 Enforcement

Enforcement of Ordinance 4977 of Cordoba City, Argentina, is performed by inspectors with sound level meters; vehicles, by municipal police; and buildings, by noise control office (municipal).

10.20.3.2 Institutional Data

10.21 South Africa

Air, sea and river pollution have in the past received more attention than noise. However, attention to the noise pollution problem has recently increased. The chief problem is the coordination of noise control activities in this country.

10.21.1 National Laws, Regulations and Guidelines

The main legal development in controlling noise problems on the national level during the last two years has been the promulgation of the hearing conservation legislation for occupational noise exposure. (10-24)

10.21.1.1 Occupational

Industrial hearing conservation legislation requires that for certain activities hearing conservation measures such as wearing earmuffs shall be carried out when the impulse corrected equivalent noise level as defined in SABS 083-1970 "The Assessment of noise exposure during work for hearing conservation purposes" exceeds 85 dBA. This mentioned document defines equivalent noise level as "the level of a steady noise that is reputed to cause a stated amount of hearing impairment to individuals who are exposed to it over a period of forty hours per week". (10-125, p. 8)

10.21.1.2 Emissions Limits-existing products

No national regulations on certain limits of noise emissions.

10.21.1.3 Emissions Limits-new products

No national regulations of any limits of noise emission.

10.21.1.4 Zoning Approaches

All civilian and military airportss are zoned for noise with controlled township development to keep residential areas away from noise. Aircraft noise therefore poses no future problem.

10.21.1.5 Other National Measures in the Legal Framework

10.21.2 Provincial and Local Legal Framework

Two South African cities, Johannesburg and Pretoria, have employed noise control officers but there is no indication of any existance of certain regulations on the provincial or local level. (10-124)

10.21.3 Enforcement and Institutional Data

10.21.3.1 Enforcement

Enforcement of the hearing conservation regulations is carried out by inspectors of the Department of Labor. In factories where noise level exceeds 85 dBA, the Chief Inspector of Factories may require workers to undergo audiometric examination at six monthly intervals. The cooperation of employers is sought, adequate grace periods are usually granted, and prosecution will only be resorted to in an extreme case. (10-124)

While the Department of Labor is involved in the enforcement of the occupational noise legislation, the South African Bureau of Standards offers technical assistance in all fields of noise measurement and assessment.

As to noise from aircraft and motor vehicles, the effects of aircraft and airport noise are assessed by using the South African Bureau of Standards documents SAB 0115-1974 "The measurement of noise and determination of disturbance from airplanes for certification purposes", SABS 0116-1974 "The procedure for calculating basic noise parameters from ICOA airplane noise cer certification data" and SAB 0117-1974 "The determination and limitation of disturbance around an aerodrome due to noise from airplanes". As to noise emissioned from motor vehicles and traffic roads, it is assessed by standards and procedures contained in documents issued by the South African Bureau of Standards. (10-124) On the local level two South African cities, Johannesburg and Pretoria, have employed noise control officers to handle noise problems and complaints.

10.21.3.2 Institutional Data

The South African Bureau of Standards offers technical assistance and develops standards and measurement rules for all fields of noise abatement and assessment. An industrial association for noise abatement exists in the Eastern Cape Province (around Port Elizabeth), and the South African Acoustics Institute has just recently been formed. The Steering Committee for Acoustics and Noise Abatement is an advisory committee to the South African Bureau of Standards consisting of members of government departments and also the private sector . (10-124)

10.22 Spain

Spain has not yet enacted a special law to deal mainly with noise control problems.

10.22.1 National Laws and Regulations

The 1972 Law on the Protection of the Atmospheric Environment Against Pollution defines noise as a form of pollution. At present, however, the basic laws or regulations controlling this type of pollution are those discussed below.

The November 30, 1961 Decree approves the regulation on nuisances and the supplemental August 16, 1968 decree of the Ministry of Interior, promulgates ordinances and takes measures to control ambient noise levels.

10.22.1.1 Occupational Noise

The most important development in this area of noise during the last two years in Spain has been the following:

1) The revision of the existing legislation regarding permissible noise levels in the industry.

2) The creation of a Social Service of Hygiene and Safety at Work charged with the detection of the existing problems related to noisy ambiences and to give the correct technical requirements.

10.22.1.2 Emission Limits - Existing Products

Motor Vehicles

Provisions specifically designed to control noise produced by vehicles are contained in Articles 90 and 210 of the Traffic Code, which require vehicles to be equipped with properly working mufflers, and in the July 10, 1965 order of the presidency, which fixes maximum noise emission levels for certain classes of vehicles and also contains provisions relating to: the inspection of vehicles, noise control devices in manufacture; fine against violators of noise regulations; and the enforcement of vehicle noise control by the Ministry of Industry and traffic authorities.

10.22.1.3 Other Measures

1) The City of Madrid has an Acoustics and Vibrations Laboratory for studying the problems related to noisy ambiences.

2) On the national level the National Institute of Normalization and Rationalization undertakes the task of representing Spain in International Commissions.

10.22.3 Enforcement and Institutional Data

10.22.3.1 Enforcement

Measures for the control of noise nuisances are a responsibility of local governments, which have issued noise control ordinances applicable to stationary noise sources as well as to traffic circulation. With regard to the manufacture of vehicles, the Ministry of Industry, through the Iron and Steel Industries Board, is responsible for specifying and enforcing noise emission controls.

In the area of occupational noise the Ministry of Labor throughout its branches of Labor Inspection and the Social Services of Hygiene and Safety at Work takes charge of supervising and controlling noise in factories. Noise problems in this area are usually solved by trying to give a collective solution or by means of individual protection. The Social Service of Hygiene and Safety at Work uses the "L_{eq}" for measuring noisy ambiences. (10-126)

10.22.3.2 Institutional Data

1) Social Service of Hygiene and Safety at Work
Ministry of Labor
Nuevos Ministerios
Madrid, Spain.

2) National Institute of Normalization and Rationalization
Serrano 150
Madrid, Spain

REFERENCES FOR CHAPTER 10

10-1 Review of noise legislation in Australia. Paper prepared by the Australian delegation to the Ad Hoc Group on Noise Abatement Policies, OECD, Paris, Nov. 5, 1975. 8 p.

10-2 Personal communication. Dept. of Public Health of South Australia, to Informatics Inc., June 2, 1976.

10-3 Else-Mitchell, R. Noise control and the law. *Shire and Municipal Record (Sydney)*, 66 (9): 737-740, 1973.

10-4 Victoria, Australia. Environmental protection act 1970, No. 8056.

10-5 Victoria, Australia. Environmental protection act 1970, amendment. Nov. 25, 1975.

10-6 Victoria Environmental Protection Authority. Draft report; environmental noise control legislation in Australia. 1975, 8 p.

References for 10.2

10-7 Verordnung des Bundesministers fur soziale Verwaltung Vom 14 Dezember 1973 ueber die gesundheitliche Eignung von Arbeitnehmern fuer bestimmte Taetigkeiten (Federal ministers of social welfare regulation no. 39 concerning capabilities of workers in special occupations). Bundesgesetzblatt, 1974 (15): 505-512, 1974.

10-8 Technologisches Gewerkemuseum, Vienna, Austria. Nachrichten des Laermbekaempfungszentrums LBZ (News of the Noise Abatement Center (LBZ)). Vienna, Austria, Versuchsanstalt fur Waerme- und Schalltechnik am Technologischen Gewerbemuseum, November 1972. 28 p.

10-9 Problems relating to environment. Report no. GE 70-22872. Geneva, ECE, 1971. 7 p.

10-10 Personal communications. Physical and Technical Institute of Thermal and Acoustic Technology, Vienna, Austria, to Informatics Inc., April 1976 and June 6, 1976.

10-11 Personal communication. Institut fuer Umwelthygiene der Univ. Wien, Vienna, Austria, to Informatics Inc., February 24, 1976.

10-12 U.S. Environmental Protection Agency. An assessment of noise concern of other nations. NTID 300.6. Springfield, VA, NTIS, PB206721, 1971. p. 346-349.

References for 10.3

10.13 U.S. EPA Office of International Activities. Environment Belgium. Washington, U.S. EPA, Feb. 16, 1976.

10.14 Hay, B. International legislation on external industrial noise. *Applied Acoustics*, 8: 133-140, 1975.

10.15 Personal communication. Acoustics and Heat Conduction Laboratory, Celestijnenlaan, Belgium, to Informatics Inc., May 7, 1976.

References for 10.4

10-16 Personal communication. Swedish Environmental Protection Agency and Swedish Employers Confederation, to Informatics Inc., January 23, 1976.

10-17 Noise abatement policy in Sweden. Paper prepared by the Swedish delegation to Ad Hoc Group On Noise Abatement Policies, OECD, Paris, November 3, 1975. 5 p.

10-18 Royal Ministry of Foreign Affairs, Royal Ministry of Agriculture, and National Swedish Environment Protection Board. Environment protection act, marine dumping prohibition act with commentaries; information to United Nations conference on the human environment. Stockholm, 1972. 85 p.

10-19 Swedish State Committee on Traffic Noise. Summary of the committee proposal for road-traffic noise standards. Sweden, 1974, 15 p. (p. 356).

10-20 National Swedish Environment Protection Board. ECE noise task force phase I - national Swedish report. Sweden, May 21, 1976. 46 p. (p. 36-44).

10-21 Personal communication. Ab Gambro Crafon, Sweden, to Informatics Inc., May 21, 1976.

References for 10.5

10-21 Personal communication. Environment Canada, Noise Control Division, Environmental Protection Service, Ottawa, Ontario, Canada, to Informatics Inc., June 10, 1976.

10-22 Personal communication. Canada Department of Labour, Manager of Program Planning and Coordination, Accident Prevention and Compensation Branch, Ottawa, Ontario, Canada, to Informatics Inc., May 26, 1976.

10-23 Canada Ministry of Labor. Canada labor code; Canada noise control regulations, amendment; registration SOR/73-66, Jan. 31, 1973. Canada Gazette, Part II, 107 (3): 268, 1973.

10-24 Personal communication. Vehicle Systems, Road and Motor Vehicle Traffic Safety Transport, Ottawa, Ontario, Canada, to Informatics Inc., May 21, 1976.

10-25 Canada Ministry of Transport. Aeronautics act; air regulations, amendment; registration SOR/72-340, Aug. 28, 1972. Canada Gazette, Part II, 106(17): 1596, 1972.

10-26 Canada Ministry of Transport. Aeronautics act; sonic and supersonic flight order; registration SOR/72-408, Oct. 4, 1972. Canada Gazette, Part II, 106(20): 1805-1807, 1972.

10-27 Canada Ministry of Transport. Motor vehicle safety act; motor vehicle safety regulations, amendment; registration SOR/75-255, Apr. 25, 1975. Canada Gazette, Part II, 109(9): 1143, 1975.

10-28 Jones, H. W., P. L. Li, and A. C. McKee. The noise environment. In Calgary noise survey. v.1. Calgary, Alberta, Canada, Univ. of Calgary, October, 1973. p. 141-185.

10.29 Shaw, E., On Canadian anti-noise laws. Ottawa, Ontario, National Research Council, 1974. 8 p.

10.30 Canada Department of Labour. 1973 industrial noise; legislation concerning industrial noise in Canada. April 1974. 30 p.

10.31 Canada Ministry of the Environment, Environmental Protection Service. Canadian environmental noise control. Ottawa, Ontario, Oct. 1975. p. 1-6.

References for 10.6

10-32 Smetana, C. Mereni Hluka a Chveni (Noise and vibration measurement). Prague, SNTL Publishers, 1974. 211 p.

10-33 Hygienicke Predpisy (Regions on Health Prevention). Prague, State Health Publishers, 1970. 15 p.

10-34 Czechoslovak State norm CSN 30 0512; measurement of noise emitted by motor vehicles. March 10, 1971. 10 p.

10-35 Personal communication. Director, Occupational Safety Research Institute, Prague, Czechoslovakia, to Informatics Inc., February 2, 1976.

References for 10.7

10.36 Noise regulations in Denmark. Paper prepared by the Denmark delegation to the Ad Hoc Group on Noise Abatement Policies, OECD, Paris, Nov. 5, 1975. 5 p.

10.37 Personal communication. Danish Standards Association, Secretariat of ISO/TC 43, to Informatics Inc., June 16, 1976.

10.38 Personal communication. Miljostyrelsen, to Informatics Inc., December 18, 1975.

References for 10.8

10-39 Finland Ministry of the Interior. Administration of the environmental protection. Helsinki, Spring 1974. 7 p.

10-40 Personal communication. Institute of Occupational Health, Regional Unit of Uusimaa, Helsinki, Finland, to Informatics Inc., February 9, 1976.

10-41 Paikkala, S. Noise abatement policy prevailing in Finland. Helsinki, Ministry of the Interior, Oct. 2, 1975. 4 p.

10-42 Personal communication. Finland Ministry of the Interior, Division for Environmental Protection, to Informatics Inc., May 5, 1976.

References for 10.9

10-43 France Ministere du Travail. Decree of August 12, 1975 on regulation of noise and worksite environment. Journal Officiel, October 12, 1975, p. 10560-10562.

10-44 France Ministere de l'Amenagement du Territoire, de l'Equipment et des Transports. Decree of April 18, 1974 on noise limits for subsonic aircraft. Journal Officiel, May 17, 1974.

10-45 Noise abatement policies in France. Paper prepared by French delegation to the Ad Hoc Group on Noise Abatement Policies, OECD, Paris, November 4, 1975. 14 p.

10-46 France Ministere de la Qualite de la Vie. Decree no. 75-960 of October 17, 1975 on household machinery and appliances. Journal Officiel, October 19, 1975. p. 1840-1841.

10-47 France Ministere de la Qualite de la Vie. Decree of November 4, 1975 on noise level limits for concrete breakers and hammers. Journal Officiel, December 11, 1975, p. 12614-12615.

10-48 France Ministere de la Qualite de la Vie. Decree of December 10, 1975 on limiting noise levels of electric power tools. Journal Officiel, January 23, 1976, p. 241-242.

10-49 France Ministere de la Qualite de la Vie. Decree of November 26, 1975 on limiting the noise of electric welding tools. Journal Officiel, December 16, 1975, p. 12861-12862.

10-50 Personal communication. Centre Scientifique et Technique du Batement, to Informatics Inc., December 3, 1975.

10-51 France Ministere de l'Equipment. Decree of December 22, 1975 on acoustic insulation of dwellings; modification of decree of June 14, 1969. Journal Officiel, January 7, 1976, p. 242.

10.52 France Ministere de la Sante. Decree no. 75-1290 of December 29, 1975 on the function and setup of the conseil superieur d'hygiene publique (Higher Council of Public Health) in France. Journal Officiel, December 31, 1975, p. 13642-13643.

References for 10.10

10-53 Verdan, G. Noise abatement in Switzerland. Paper prepared for the sixth OECD meeting of the Urban Environment Sector Group, Paris, April 1974. 14 p.

10-54 Roulin, J. Mesures prises et travaux en cours sur le plan federal en matiere de lutte contre le bruit (Measures taken and work in progress at the federal level of noise abatement). Bern, Switzerland, Federal Office for Environmental Protection, September 1975. 12 p.

10-55 Personal communication. Federal Office for Enivronmental Protection, Section on Noise Abatement, Motors, Engines and Machinery, Bern, to Informatics Inc., December 23, 1975.

10-56 Personal communication. Eidgenoessisches Luftamt, Bern, to Informatics Inc., February 13, 1976.

10-57 Institut Sociologique de l'Universite de Zurich. Enquetes socio-psychologiques sur le bruit des avions dans le perimetre des trois aeroports suisses de Zurich, Geneve et Bale (Social and psychological surveys on aircraft noise within the perimeter of Zurich, Geneva and Basel airports). Bern, Switzerland, Office Federal de l'Air, May 1974. 51 p.

10-58 Office Federal de l'Air. Noise abatement by means of a special approach procedure. Aeronautical Information Circular, March 27, 1975.

10-59 Noise abatement requirements. AIP Switzerland, v.214, November 30, 1975.

10-60 Schurter, E. Noise limit excesses during daytime and night. Laerm Bulletin, November 1975, 1 p.

10-61 Personal communication. Office Federal de la Protection de l'Environment, Section of Motors and Machines, Bern, to Informatics Inc., May 28, 1976.

10-62 Service Federal des Routes et des Digues. Protection contre les atteintes nuisibles en bordure des routes nationales (Protection against harmful effects along the national traffic routes). Bern, Office Central Federal des Imprimes et du Materiel.

10-63 Birchler, F. Jahresbericht 1971 der Laermbekaempfungs stelle (Annual report 1971 of the noise abatement). Zurich, City Police, January 4, 1972. 3 p.

10-64 Roulin, J. La lutte contre le bruit du a la construction et aux machines de chantier (Noise abatement at construction sites and in building machinery). Bern, Federal Office for Environmental Protection, September 1975. 10 p.

10-65 Grandjean, E. Untersuchungen ueber die Fluglaermwirkungen in der Schweiz (Study of aircraft noise in Switzerland). In Boehlen, B., Laermbekaempfung. Zurich, BAG Brunner Verlag AG, 1974. p. 152-173.

References for 10.11

10-66 Umweltbundesamt, Laermbereich. On the situation of noise, noise abatement and noise control in the Federal Republic of Germany. January 1976. 18 p.

10-67 Noise abatement policy in the Federal Republic of Germany. Paper prepared by the German delegation to the Ad Hoc Group on Noise Abatement Policies, OECD, Paris, Nov. 5, 1975, 11 p.

10-68 Verein Deutscher Ingenieure. Laermarm Konstruieren. VDI-Berichte No. 239. Dusseldorf, 1975. 247 p.

10-69 Personal communication. Verein Deutscher Ingeniere (VDI), to Informatics Inc., January 15, 1976.

10-70 GdT-Informationsstelle ueber technische Regelwerke beim DVT. Regeln und Vorschriften der Technik zum Schutz gegen Laerm (Rules and regulations on protection from noise). Dusseldorf, November 1975. 37 p.

10-71 Gesetz zum Schutz vor Luftverunreinigungen, Geraeuschen und aehnlichen Umwelteinwirkungen (Law on protection from air pollution, noise and similar environmental effects). Land Nordrhein-Westfalen, Duesseldorf, March 18, 1975. 2 p.

10-72 U.S. Department of State. Acoustic and noise measurement and control. Airgram March 5, 1974. 17 p.

10-73 Hansmeyer, K. H. *ed*. Umweltgutachten 1974. Stuttgart, Verlag W. Kohlhammer GMBH, March 1974. 320 p.

10-74 Personal communication. Physikalisch-Technische Bundesanstalt, Fed. Rep. of Germany, to Informatics Inc., May 18, 1976.

References for 10.12

10-75 The existing situation with respect to noise control in the Netherlands. Paper prepared by the Netherlands delegation to the Ad Hoc Group On Noise Abatement Policies, OECD, Paris, November 5, 1975.

10-76 Personal communication. Ministerie van Volksgezondheid en Milieuhygiene, Deputy Director of International Affairs, to Informatics Inc., December 30, 1975.

References for 10.13

10-77 Taylor, R. Noise legislation in Britain. In Proceedings; InterNoise 1972, Washington, October 4-6, 1972. p. 29-30.

10-78 Noise Advisory Council Panel on Noise in the Seventies. Noise in the next ten years. London, Dept. of the Environment, 1974. 15 p.

10-79 Coles, R. R., and A. M. Martin. Medico-legal aspects of occupational hearing loss. Journal of Sound and Vibration, 28(3):369-373, 1973.

10-80 Noise abatement policy prevailing in the United Kingdom. Paper prepared by the United Kingdom delegation to the Ad Hoc Group On Noise Abatement Policies, OECD, Paris, Nov. 3, 1975. 5 p.

10-81 Lerse, C. Legal aspects of noise control. In Proceedings; Noise and Vibration Control Conference, University of Bath, April 8-10, 1974.

10-82 Jones, I. D. Computer aids for evaluating traffic noise from roads. Surveyor, (4292):40-45, 1974.

10-83 Personal communication. Deputy Chief Inspector of Factories of the British Health Safety Executive, Hazardous Substances Group-Brand D, London, to Informatics Inc., June 11, 1976.

10-84 Personal communication. Institute of Sound and Vibration Research, University of Southampton, to Informatics Inc., June 7, 1976.

10-85 Large, J. B., and R. M. Taylor, The law of the noise in the United Kingdom, existing and intending. In Proceedings; InterNoise 1975, Sendai, Japan, August 27-29, 1975. p. 717.

10-86 Hay, B. A review of legislation on industrial noise. *Applied Acoustics*, 7(4):265-270, 1974

References for 10.14

10-87 Personal communication. A. I. Acoustics, Tigva, Israel, to Informatics Inc., April 1976.

10-88 Strumpf, F. M. Noise measurements on merchant ships and the development of regulations and hearing conservation program in Israel. 1974. 4 p.

10-89 Personal communication. Israel Ministry of the Interior, Environmental Protection Service, to Informatics Inc., May 8, 1976.

10-90 Strumpf, F. M. The law of public nuisance--noise in Israel. *In* Proceedings; InterNoise 75, Sendai, Japan, August 27-29, 1975. p. 539-542.

References for 10.15

10-91 Personal communication. Italian Ministry of Labor, to Informatics Inc., April 21, 1976.

10-92 Hay, B. International legislation on external industrial noise. *Applied Acoustics*, 8:133-140, 1975.

References for 10.16

10-93 Hashimoto, M. Present status of noise regulations and control in Japan. In Proceedings; InterNoise 1975, Sendai, Japan, August 27-29, 1975. p. 719-730.

10-94 Modig, C. Directory to noise information resources in Japan, Rockville, Informatics Inc., December 1975.

10-95 Personal communication. Director General of Air Quality Bureau, Environment Agency, Tokyo, to Informatics Inc., July 14, 1976.

10-96 Japan Environment Agency. Environmental quality standards for aircraft noise. Environment Agency Notification No. 154. December 27, 1973. 5 p.

10-97 Personal communication. Environment Agency, Air Quality Bureau, Tokyo, to Informatics Inc., April 13, 1976.

10-98 U.S. EPA Office of International Activities. Airport of Japan. November 14, 1975.

References for 10.17

10-99 Hay, B. International legislation on external industrial noise. Applied Acoustics, 8: 133-140, 1975.

10-100 Personal communication. Statens Teknologiske Institut, Oslo, to Informatics Inc., February 24, 1976.

10-101 Personal communication. Statens Forurensningstilsyn, to Informatics Inc., January 27, 1976.

10-102 Government of Norway. The United Nations Conference on the Human Environment, a national report, 1971.

References for 10.18

10-103 Puzyna, C. Normalizacia w walce z Halasem (Normalization in noise abatement). Warsaw, Wydawnictwo Normalizacyjne, 1973. 199 p.

10-104 Sadowski, J. Akustyka w Urbanistyce, Architekturze i Budownictwie (Acoustic problem in urban development, architecture and building industry). Warsaw, Arkady Publishers, 1971. 867 p.

10-105 Grzesik, J. and F. Piecha. Noise level assessment in selected branches of industry based on observations conducted in 1960-1971. Medycyna Przemyslowa, 24(2): 202-210, 1973.

10-106 Puzyna, C. Zagadnienia Akustyczne w Zakladach Przemysowych (Acoustic problems in industrial enterprises). Warsaw, Central Council of Trade Unions Publishers, 1967, 311 p.

References for 10.19

10-107 Bobin, E. V. Bor'ba protiv Zhelezno -dorozhnovo Shuma i vibratsii (Fight against railroad noise and vibration). 3d ed. Moscow, Transport Publishers, 1973. 304 p.

10-108 USSR Ministry of Heavy Metallurgy. Rekomendatsii po zaschite pabotschikh om shuma na metallurgicheskikh predpreyatiy (Recommendations for the protection of workers from noise in metallurgical enterprises). Chelyabinski, Heavy Metallurgy Work Protection Institute (NNI), 1973. 120 p.

10-109 Yanin, L. V., ed. Sbornik vazhneyshikh ofitsial'nykh materialov po voprosam gigieny truda i proizvodstvennoy sanitarii (Collection of most important official documents concerning work hygiene and industrial sanitation). Moscow, Meditsinskaya literatura, 1962.

10-110 Vozzhova, A. I. and V. K. Zakharov. Zashchita ot shuma i vibratsii na sovremennykh sredstvakh transporta (Protection of modern transport from noise and vibration). Leningrad, Meditsina, 1968.

10-111 Kalyuzhnyy, D. N. et al. Gigienicheskaya problema ozdorovleniy vneshney sredy v svyazi s razvitiyem promyshlennosti i stroitel'stva naselennykh mest (Hygiene problem of environmental protection in connection with industrial development and construction of residential areas). Gigiena i Sanitariya, 32:315-319, 1967.

10-112 Bobin, E. V. Bor'ba s proizvodstvennym shumom i vibratsiey na zheleznodorozhnom transporte (Fight against industrial noise and vibration on the railroads). Moscow, Transport Publishers, 1967.

10-113 Sidorenko, S. S., *ed.* Spravochnik po tekhnike bezopasnosti i proizvodstvennoy sanitarii (Guide to safety techniques in industrial sanitation). v. 5. Leningrad, Sudostroeniye, 1964.

10-114 Sadekov, B. Tikha kak v Rige(As quiet as in Riga). *Nedelya*, 21:7, 1974.

10-115 Karagodina, I. L., G. L. Osipov, and I. A. Shishkin. Gorodskiye i zhilishchno- kommunal'nyye shumy i bor'ba s nimi (Community noise and the fight against it). Moscow, Meditsina, 1964.

10-116 Denisov, E. I. Novyye sanitarnyye normy po shumu (New sanitary norms for noise). *Gigiena truda i professional'nyye zabolevaniya*, 14(5): 47-48, 1970.

10-117 Personal communication. Leningrad Institute of Safety Engineering, to Informatics Inc., December 12, 1973.

10-118 Soldatkina, S. A. and G. L. Osipov. (Evaluation of soundproofing in hospitals and sanitoria). *Gigiena i Sanitariya*, 35(10): 91-93, 1970.

10-119 Kovrigin, S. D., A. P. Mikheyev et al. Uluchsheniye usloviy truda na predpriya tiyakh svyazi - shum i osveshcheniye (Improving work conditions in the communications industry - noise and lighting). Moscow, Svyaz, 1968.

10-120 Orlova, T. A. Problema bor'by s shumom na promyshlenykh predipriyatiyakh (Problem of noise in industrial enterprises). Moscow, Meditsina, 1965.

10-121 Denisov, E. I. Novyye sanitarnyye normy po shumu (New sanitary norms for noise). *Gigiena truda i professional'nyye zabolevaniya*, 14(5): 47-48, 1970.

10-122 Sov. Deputatov. Sbornik Zakonov SSR 1936-1967 (Collected laws of the USSR 1936-1967). v. 2. Moscow, Izvestiya, 1968.

References for 10.20

10-123 Fuchs, G. L. Subjective evaluation of transport noise in Latin America. *Journal of Sound and Vibration,* 43(2): 387-394, 1975.

References for 10.21

10-124 Personal communication. South African Bureau of Standards, to Informatics Inc., January 1976.

10-125 South African Bureau of Standards. Code of practice for the assessment of noise exposure during work for hearing conservation purposes. SABS 083-1970. Pretoria, 1970. 15 p.

References for 10.22

10-126 Personal communication. Social Service of Hygiene and Safety at Work, Seville, to Informatics Inc., December 1975.

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